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THIRTEEN YEARS' EXPERIENCE WITH PYLOROPLASTY[1]

A STUDY OF ONE HUNDRED CASES

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IT is now over twelve years since the operation of pyloroplasty was first introduced by Finney, who, at the annual meeting of the American Surgical Association, in 1902, described the operation and reported five successful cases. It seemed to us, therefore, that it would not be out of place, after this period of time, to bring together the results of this operation, and discuss the advantages or disadvantages of this procedure over others performed for a similar purpose, and to draw, as far as possible, definite conclusions regarding its indications and value as a surgical procedure. In gathering our experiences, we deem it most important that not only should the immediate effects be noted, but also the final results, i.e., the results obtained after a term of years.

The special operation of pyloroplasty consists in a horseshoe-shaped incision through the pylorus, extending down through the anterior walls of the duodenum, and the stomach, after they have been approximated, and sutured much as in a lateral anastomosis. Since this time Narath, Jaboulay, Henle, Kocher, and others have described similar methods or modifications of this operation, but none of these present any material advantage over the original method. The operation may be described as follows: Adhesions binding the pylorus to neighboring organs should be thoroughly freed, as well as the pyloric end of the stomach, and first portion of the duodenum.

The thoroughness with which the pyloric end of the stomach and the upper end of the duodenum are freed determines largely the ease and success of the operation. Much advantage is gained from this so-called mobilization of the duodenum. Kocher later emphasized the great importance of this procedure. A suture to be used as a retractor is taken in the upper wall of the pylorus, which is then retracted upward by means of this suture. A second suture is then placed in the anterior wall of the stomach, and a third in the anterior wall of the duodenum at equidistant points from the suture just described in the pylorus. The second and third sutures are taken as near the opposing free borders of the stomach and duodenum as possible, and mark the lower ends of the gastric and duodenal incisions respectively.

Traction is then made upward on the pyloric suture, and downward in the same plane on the gastric and duodenal sutures.

[1] Read before the Clinical Congress of Surgeons of North America, Chicago, November 12, 1913.

This keeps the stomach and duodenal walls elevated and taut, and allows the placing of the subsequent sutures with greater facility than if they remained retracted and relaxed. The peritoneal surfaces of the duodenum and stomach along its greater curvature, are then sutured as far posteriorly as possible. For this row the continuous silk suture is to be preferred.

After the posterior line of sutures has been placed and tied, an anterior row of mattress sutures is taken, which are not tied. These sutures after they have been placed are drawn aside, thus exposing the line of incision.

After all the anterior stitches have been placed and retracted the incision is made in the shape of a horseshoe. The anterior and posterior lines of sutures should be placed far enough apart to give ample room for the incision to be made between them. Beginning in the gastric wall, the incision is carried upward to and through the pylorus, and around into the duodenum. Hæmorrhage is then stopped. Scar tissue or active ulcers present in the gastric or duodenal anterior wall may be excised through this incision.

Those in the posterior wall we have been treating of late just as other chronic ulcers; i.e., excising the overhanging edges of mucous membrane, and incising the dense fibrous base; care being exercised to avoid perforation of the posterior wall of the stomach and to stop all hæmorrhage by ligature or suture.

The opportunity thus afforded to explore digitally and inspect the ulcerated area and then excise it through this incision is in our judgment one of the strongest points in favor of the operation.

A continuous catgut suture is now taken through all the coats of the stomach and duodenum on the posterior side of the incision in order to reinforce this line of sutures. The anterior sutures are then straightened out and tied, and the operation thus completed. The mattress sutures may be reinforced with as many Lembert sutures as may be thought best. All the stitches are thus placed and the posterior row tied before the bowel is opened, and it remains open only long enough to control the hæmorrhage and excise any ulcer that may be present, thus giving the minimum of exposure of infected surfaces.

The size of the newly formed pylorus may be made as large or small as desired. Unless the stomach is very much dilated or has descended to an unusual extent, the lower limit of the new pylorus will be found to be at or near the level of its most dependent part.

We have studied the records of 100 cases in which the operation of pyloroplasty has been performed, covering a period dating from 1900 to the present time. Of these the immediate results were noted in all cases; the remote results in 78 cases.

In analyzing our results we note that the largest proportion of cases in which pyloroplasty was performed occurred between the 35th and 50th years.

TABLE PRESENTING CASES ARRANGED ACCORDING TO AGE

Years	No.	Per Cent	Years	No.	Per Cent
20–25	5	5	45–50	15	15
25–30	9	9	50–55	10	10
30–35	9	9	55–60	11	11
35–40	20	20	60–65	3	3
40–45	14	14	65–70	4	4

Of the total number there are 63 males and 37 females. The following tables illustrate the number of cases observed in males and females according to age.

CASES GROUPED ACCORDING TO AGE AND SEX

Years	Males No.	Males Per Cent	Females No.	Females Per Cent	Total No.	Total Per Cent
20–25	1	1	4	4	5	5
25–30	4	4	5	5	9	9
30–35	7	7	2	2	9	9
35–40	9	9	11	11	20	20
40–45	10	10	4	4	14	14
45–50	10	10	5	5	15	15
50–55	10	10	0	0	10	10
55–60	9	9	2	2	11	11
60–65	2	2	1	1	3	3
65–70	1	1	3	3	4	4
Total	63	63	37	37	100	100

The duration of the symptoms in our cases varied greatly, ranging from one and one-half months to twenty-five years; the average duration being nine and a half years. The following table presents the cases grouped according to the duration of symptoms.

CASES GROUPED ACCORDING TO DURATION OF SYMPTOMS

Time	No. of Cases	Time	No. of Cases
1½ months	1	4 years	10
2 months	1	5 years	8
3 months	2	8 years	3
6 months	5	9 years	1
8 months	4	10 years	6
9 months	2	11 years	1
10 months	1	12 years	3
1 year	15	15 years	2
1½ years	5	17 years	1
2 years	9	20 years	5
3 years	11	25 years	1
3½ years	1		

Average duration of symptoms, 9½ years; 8½ years in males, and 11 years in females.

We have noted the principal symptoms observed in both males and females at various ages. Of these, pain was observed in 92 per cent of cases (58 males and 34 females); vomiting occurred in 64 per cent of cases (44 males and 20 females); hæmatemesis in 21 per cent of cases (15 males and 6 females); melæna in 46 per cent (29 males and 17 females); retention in 42 per cent (27 males and 15 females).

TABLE PRESENTING THE PRINCIPAL SYMPTOMS ARRANGED ACCORDING TO THEIR OCCURRENCE AT VARIOUS AGES

Age	Pain			Vomiting			Hæmatemesis			Melæna			Retention		
	M.	F.	Total	M.	F.	Total	M.	F.	Total	M.	F.	Total	M.	F.	Total
20–30	4	9	13	3	5	8	1	1	2	2	5	7	2	4	6
30–40	15	12	27	10	7	17	4	2	1	7	7	14	6	5	11
40–50	19	9	28	14	5	19	6	2	8	12	2	14	9	4	13
50–60	18	2	20	16	1	17	3	0	3	6	2	8	8	1	9
60–70	2	2	4	1	2	3	1	1	2	2	1	3	2	1	3
Total	58	34	92	44	20	64	15	6	21	29	17	46	27	15	42

In the following table we have arranged the cases of gastric and duodenal ulcers according to age and sex. There are 55 cases of gastric ulcer (36 males and 19 females) and 32 duodenal ulcers (21 males and 11 females) making a total of 87 cases. In addition pyloroplasty was performed upon two cases for gastroptosis, in three for pylorospasm and six for pyloric stenosis, due to adhesions (one due to cholelithiasis, four due to adhesions of undetermined cause, and one to closing of a former gastro-enterostomy opening). Two cases presented both gastric and duodenal ulcers.

TABLE GROUPING THE GASTRIC AND DUODENAL ULCERS ACCORDING TO AGE AND SEX

Age	Males		Females	
	Gastric No.	Duodenal No.	Gastric No.	Duodenal No.
20–30	4	1	4	2
30–40	11	5	8	4
40–50	10	6	4	3
50–60	10	8	2	0
60–70	1	1	1	2
Total	36	21	19	11

Of the 87 cases, obstruction of the pylorus occurred in 64 instances.

The obstruction was due in 51 cases to gastric ulcer,[1] in 7 to duodenal ulcer, and in 6 to adhesions, probably resulting from healed ulcers. There were four cases requiring secondary operations (gastro-enterostomy).

TABLE ILLUSTRATING CASES REQUIRING SECONDARY OPERATION—GASTRO-ENTEROSTOMY

Age	Sex	Cause
58	F	Pyloric obstruction due to adhesions produced by gall-bladder infection, eleven years after the pyloroplasty.
52	M	Duodenal ulcer formed five years after pyloroplasty.
48	M	Infected sutures causing immediate obstruction at site of pyloroplasty requiring gastro-enterostomy after five days.
41	M	Duodenal ulcer after one and one-half years.

In one case there occurred a pyloric obstruction due to adhesions produced by cholecystitis eleven years after the pyloroplasty. In the second, a duodenal ulcer formed four years after the pyloroplasty. In the third, infected suture (linen thread) caused early obstruction at the site of the pyloroplasty, and in the fourth a duodenal ulcer formed after a year and a half. In all of these cases secondary gastro-enterostomies had to be performed, which gave entire relief.

In both of the cases where a duodenal ulcer recurred, an attempt had been made, at the original operation, to excise a duodenal ulcer, but owing to the fact that it was so situated that it could not be entirely excised, it is more than probable that in one of the cases, at least, it was a direct recurrence. In the

[1] While the histories state positively in 51 cases that the obstruction was due to gastric ulcer, and in only 7 to duodenal ulcer, it is possible that in the earlier cases, when we did not examine as carefully as now, the error may have been made in certain cases of calling a duodenal a gastric ulcer, but we cannot believe that the error was very large.

other, the second ulcer appeared to be so far removed from the site of the first, as to give the impression, at least, that it was an independent ulcer.

The following table illustrates the immediate results of pyloroplasty of the 100 cases, consisting of 63 males and 37 females; the operations proved satisfactory immediately in 57 males and 33 females (90 per cent) and unsatisfactory in 6 males and 4 females (10 per cent). The post-operative nausea and vomiting was almost entirely absent in most instances. In but five cases was there nausea or vomiting to any marked degree following operation. Vomiting occurred in two cases eight and twelve days after operation respectively, but this was due in each instance to gross errors in feeding. The great freedom from discomfort following immediately after operation is also to be noted as a distinct advantage of this procedure. In but seven instances were the patients greatly disturbed by nausea, flatulency, or distention, and the immediate results of this operation may be favorably compared with those observed after appendectomy when performed between attacks, being attended with almost as little discomfort. Diarrhœa after operation appeared in five instances, mainly, however, after the first week or ten days, and was usually due to errors in diet. Inasmuch as the operation is performed in most instances upon patients affected with pyloric obstructions, and often after having this condition for years, it is easily understood how, on account of the rapid passage of the gastric contents through the stomach, a weakened intestine may be overtaxed, and intestinal indigestion and diarrhœa be induced. On this account, as well as because the stomach has in most instances temporarily lost its tone, and inasmuch as in some instances portions of ulcers have not been entirely resected due to their location and extent, we have found it advisable to regulate the diet following immediately upon operation and continuing on for several months according to the following plan which has been found very satisfactory.

For two days after operation nourishment is administered only by means of rectal alimentation. Normal salt solution or plain water, after Murphy's method, is begun immediately after operation, with nutrient enemata at intervals of every four hours on the second and third days. On the third day after operation egg-albumin is given in teaspoonful doses, gradually increased to one-half ounce every two hours on the fourth day, and two ounces on the fifth day. On the eighth day any liquid is permissible, and on the eleventh day the patient is given a soft boiled egg; on the thirteenth, soft diet; on the fifteenth, very restricted light diet; on the sixteenth, a restricted light diet; on the eighteenth day, light solid food. Small quantities of water at a time are allowed by mouth after 24 hours.

DIET LIST FOLLOWING THE OPERATION OF PYLOROPLASTY

First day, first 12 hours, nothing by mouth; nutrient enemata every 4 hours, alternating with continuous salt solution by Murphy's method.

First day, second 12 hours, water in dram doses.

Second day, increase water gradually up to 1 ounce every two hours.

Third day, water, 1 ounce, alternating with albumin, 1 dram. Gradually increase quantities of each until

Eighth day, any liquid, 2 ounces every two hours.

Ninth day, any liquid, 3 ounces every two hours.

Tenth day, any liquid, 4 ounces every two hours (discontinue rectal feeding).

Eleventh day, one soft boiled egg in addition to any liquid.

Twelfth day, two soft boiled eggs in addition to any liquid.

Thirteenth day, soft diet.

Fourteenth day, soft diet.

Fifteenth day, very restricted light diet.

Sixteenth day, restricted light diet.

Seventeenth day, restricted light diet.

Eighteenth day, any digestible solid food.

After the eighteenth day the following diet list may be gradually followed, and should be continued for at least four or five months: Soups; any light soup. Meats; any

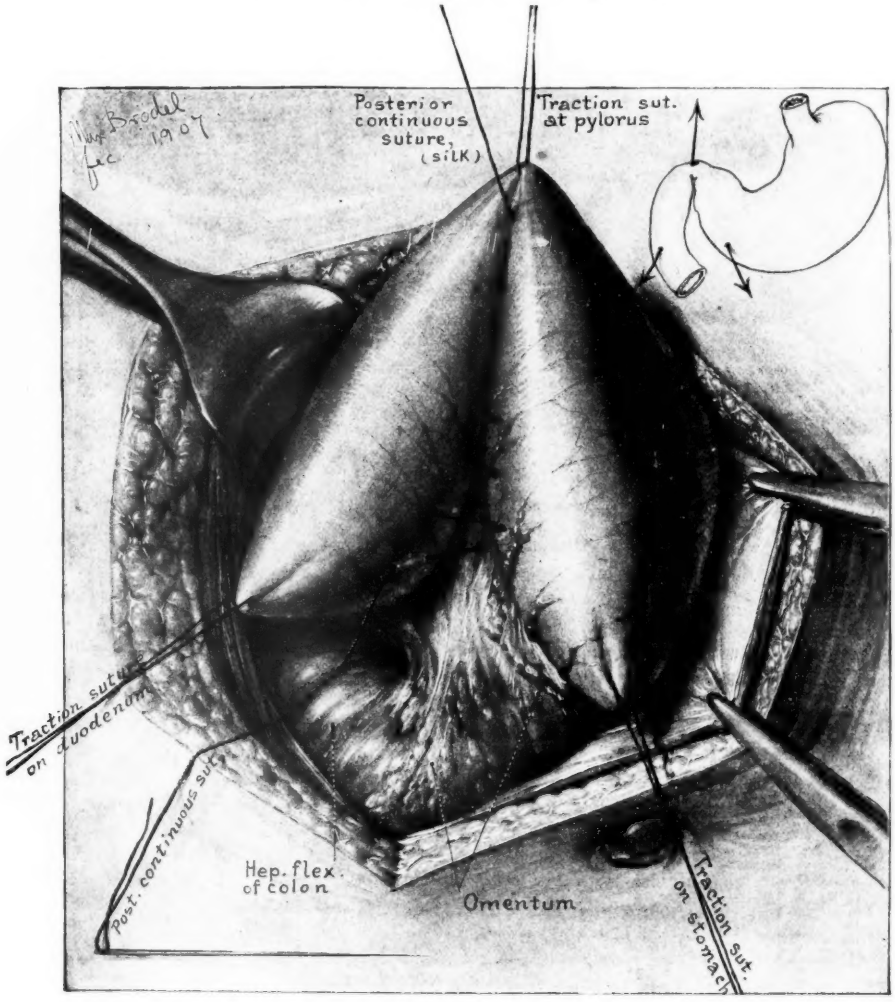

Plate 1. Showing traction stitches in pylorus, stomach, and duodenum. Posterior line of suture nearly completed. Finney in Kelly and Noble's Gynecology, Vol. II. Kindly presented by W. S. Saunders Co.

of the easily digestible meats, as brains, sweetbreads, beef, mutton, lamb, or poultry (best minced, and taken either broiled or boiled). Fish; mainly the white variety, mackerel, rock bass, as well as oysters (boiled or broiled). Eggs; in any form except fried. Vegetables; best taken mashed and strained; the easily digestible forms as asparagus, spinach, peas, beans, potatoes, carrots. Farinaceous food; any of the cereals; bread to be taken stale. Desserts; any of the light puddings. Fruits; mainly stewed. Fatty food; cream, butter and olive oil. Drinks; milk, buttermilk, cocoa, carbonated mineral waters and plain water.

The following must be avoided: Rich soups, fried foods, pork, veal stews, hashes, corned meat, potted meat, twice cooked

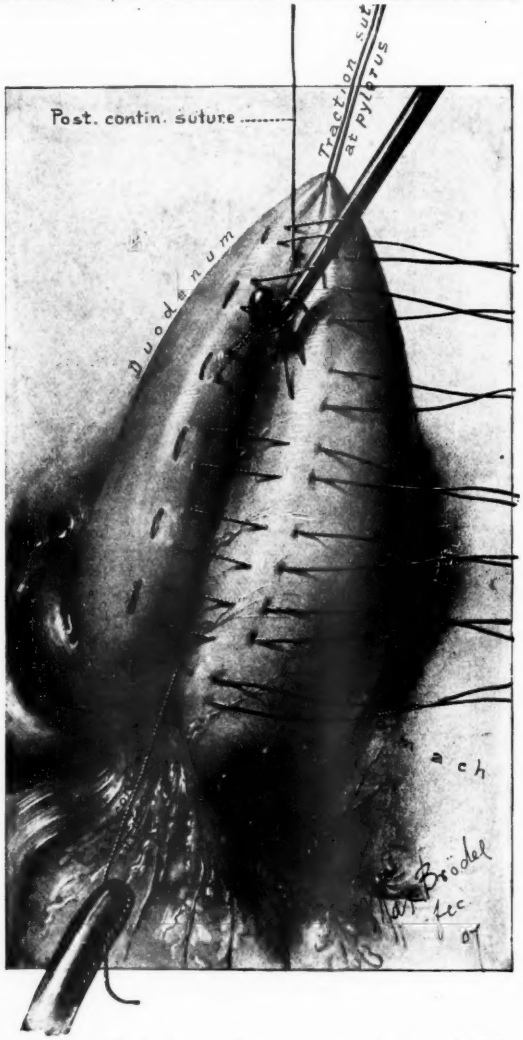

Plate 2. Posterior continuous suture placed and tied. Ends left long as retractors. Anterior row of mattress sutures placed but not tied. Finney in Kelly and Noble's Gynecology, Vol. II. Kindly presented by W. B. Saunders Co.

meat, liver, kidney, duck, goose, sausage, crabs, sardines, lobster, preserved fish, smoked fish, salted fish, salmon, cauliflower, celery, radishes, cabbage, cucumbers, sweet potatoes, tomatoes, beets, corn, salads, bananas, melons, berries, pineapple, hot bread, or cakes, nuts, candies, pies, pastry, preserves, cheese, strong tea, strong coffee, alcoholic stimulants.

IMMEDIATE RESULTS

Age	Males		Females	
	Satisfactory	Unsatisfactory	Satisfactory	Unsatisfactory
20–30	5	0	7	2
30–40	15	1	13	0
40–50	19	1	8	1
50–60	16	3	1	1
60–70	2	1	4	0
Total	57	6	33	4

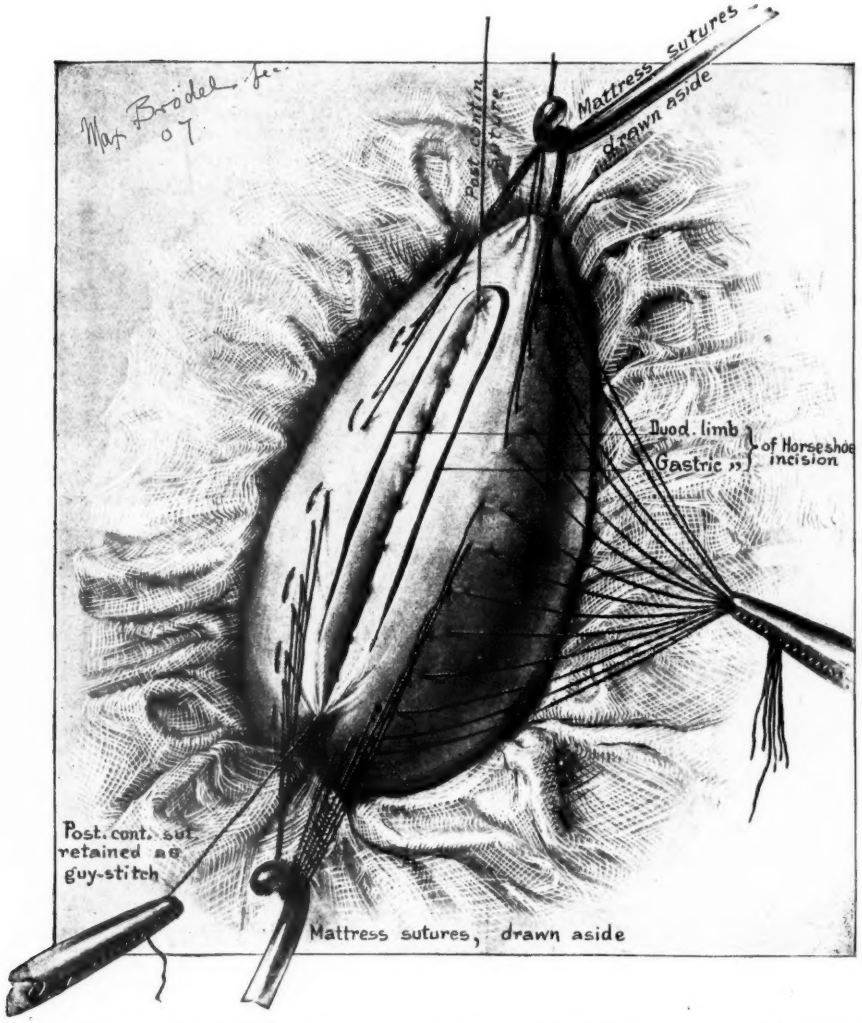

Plate 3. Anterior mattress sutures retracted. Incision completed through the anterior gastric and duodenal walls. Finney in Kelly and Noble's Gynecology, Vol. II. Kindly presented by W. B. Saunders Co.

In order to obtain a clear view as to the immediate results of the operation we have compared the gastric secretion, in the following four cases of pyloric stenosis due to ulcer, before the operation, with that obtained one and two months after operation. The figures given are an average of a number of examinations. The total acidity is first noted, then the amount of free hydrochloric acid, and finally the quantity of contents recovered, which in a measure represents the motor activity of the stomach. It is evident in every case that the total quantity of acid as well as the percentage of free hydrochloric acid, which may be exceedingly high before operation, is gradually reduced to normal. but that this does

Plate 4. Anterior gastric and duodenal walls retracted, showing buttonhole suture of catgut partly placed in the free borders of the posterior walls. Finney in Kelly and Noble's Gynecology, Vol. II. Kindly presented by W. B. Saunders Co.

not occur immediately after operation, but requires about two months before the normal is established, after which it continues to remain stationary. Similarly the large quantity of contents obtained is gradually reduced to normal after operation, while the retention observed at first entirely vanishes. It is, therefore, evident, that while the secretory and motor functions of the stomach are at once markedly improved after pyloroplasty, these functions do not become normal immediately, but several months must elapse before perfectly normal conditions are established.

E. V. N., Operation May 13, 1904.

	Total Acidity	Free HCl	Quantity of Contents After Test Meal	Quantity of Contents On Fasting Stomach
Before operation:				
April 2, 1904.....	110	86	310 cc.	245 cc.
After operation:				
June 24, 1904....	74	62	82 cc.	0
July 20, 1904....	48	42	58 cc.	0
Sept. 5, 1904....	44	38	46 cc.	0

R. M., Operation Dec. 16, 1905.

Before operation:				
Nov. 10, 1905....	76	65	205 cc.	185 cc.
After operation:				
Jan. 21, 1905....	62	58	98 cc.	0
Feb. 24, 1905....	52	44	62 cc.	0
April 2, 1905....	48	36	50 cc.	0

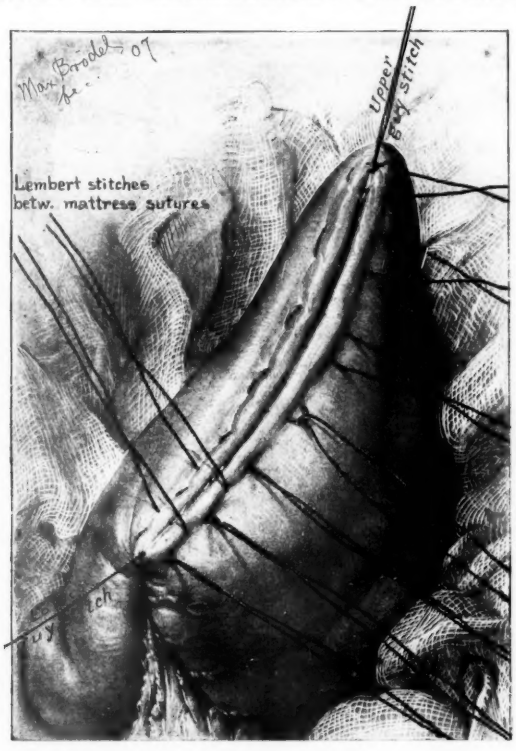

Plate 5. Mattress sutures previously placed now tied. Alternate Lemberts placed between the mattresss utures. Finney in Kelly and Noble's Gynecology, Vol. II. Kindly presented by W. B. Saunders Co.

C. E. R., Operation May 2, 1907.				
Before operation:				
April 15, 1907....	96	82	230 cc.	200 cc.
After operation:				
June 20, 1907....	92	76	88 cc.	0
July 25, 1907....	62	54	45 cc.	0
Sept. 2, 1907....	50	36	48 cc.	0
J. B., Operation March 19, 1902.				
Before operation:				
Mar. 12, 1902....	100	59	435 cc.	400 cc.
After operation:				
April 25, 1902....	84	52	85 cc.	0
May 28, 1902....	64	48	40 cc.	0
July 13, 1902....	54	42	45 cc.	0

Deaths following operation. There were five deaths following immediately upon operation, these occurred from the fifth to the fifteenth day. In one instance death was due to persistent vomiting, due to an acute atrophy of the liver associated with the toxæmia of pregnancy, in a second and third to bronchopneumonia in very debilitated subjects, in a fourth to shock, associated with diabetes and followed by coma, and in a fifth to chronic nephritis and uræmia.

IMMEDIATE RESULTS—DEATHS

The following table illustrates the number of deaths following immediately upon operation, with cause of death:

Sex	Age	Day of Death After Operation	Cause of Death
F	26	15	Persistent vomiting associated with pregnancy.
M	60	5	Atrophy of liver.
M	50	6	Bronchopneumonia.
M	58	5	Shock.
M	59	5	Chronic nephritis (uræmia).

The results of pyloroplasty during the first year of the operation are satisfactory on

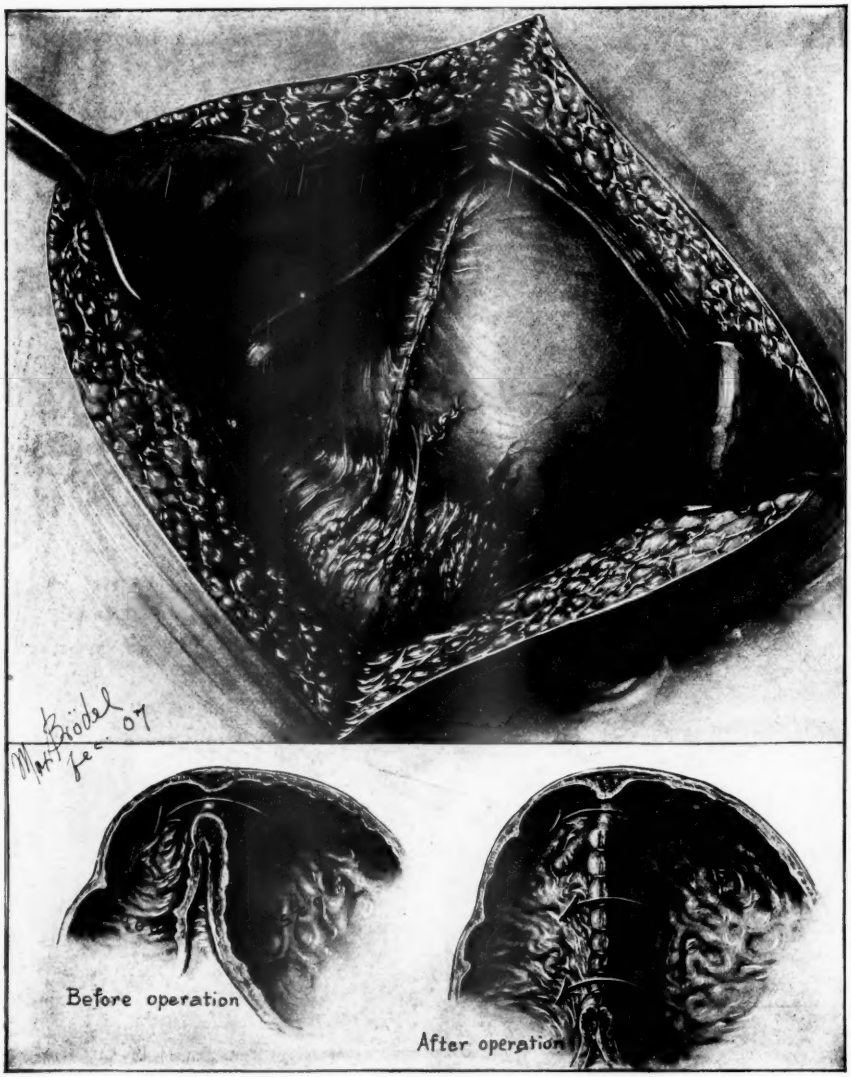

Plate 6. Operation completed. Showing relative sizes of old and new pylorus. Finney in Kelly and Noble's Gynecology, Vol. II. Kindly presented by W. B. Saunders Co.

the whole. Of the 100 cases operated on, 5 had died immediately following operation and the results of 13 could not be obtained; the results are therefore tabulated only in 82 cases, consisting of 54 males and 28 females; the results were entirely satisfactory in 51 males and 26 females, that is in 77 instances (93.9 per cent), and unsatisfactory in 3 males and 2 females, that is in 5 instances (6.1 per cent).

TABLE ILLUSTRATING RESULTS OF OPERATION DURING FIRST YEAR

	Males		Females	
Age	Satisfactory	Unsatisfactory	Satisfactory	Unsatisfactory
20–30	4	0	4	1
30–40	14	1	11	1
40–50	18	1	7	0
50–60	14	1	0	0
60–70	1	0	4	0
Total	51	3	26	2

RESULTS AFTER FIRST YEAR OF REMAINING 78 CASES

Of the total of 100 cases the final results of 17 are unknown, while 5 died soon after operation, leaving 78 cases. Of these, the results were satisfactory in 50 males and 23 females, that is 73 (93.6 per cent), and unsatisfactory in one male and 4 females, that is 5 (6.4 per cent).

RESULTS AFTER FIRST YEAR OF REMAINING 78 CASES

	Males		Females	
Age	Satisfactory	Unsatisfactory	Satisfactory	Unsatisfactory
20–30	4	0	3	1
30–40	14	0	10	2
40–50	18	0	6	1
50–60	13	1	0	0
60–70	1	0	4	0
Total	50	1	23	4

In the following table are noted the number of cases that have been observed from one to twelve years after operation, together with the final results. The average of the satisfactory recoveries is shown to be 93.4 per cent. If we deduct from this number 5 per cent, that is those cases already referred to in which death occurred immediately upon operation, the percentage of favorable results is reduced to 88.8 per cent.

As an additional factor in determining the satisfactory results in addition to freedom from digestive disturbances, gain in weight, and general well-being, we have had a series of X-ray plates made in five cases, all of which had been operated on over one year, and the stomach was found to be functionating perfectly normally in all, emptying itself at a normal rate. As a whole the final results of pyloroplasty have, therefore, proven satisfactory.

END RESULTS IN YEARS AFTER OPERATION OF PYLOROPLASTY

Years	Total Number of Cases	Satisfactory Results	Unsatisfactory Results	Percentage of Satisfactory Recoveries
1	4	4	0	100
2	5	5	0	100
3	12	11	1	91.6
4	7	7	0	100
5	5	5	0	100
6	8	8	0	100
7	6	6	0	100
8	10	8	2	80
9	8	8	0	100
10	5	4	1	80
11	4	4	0	100
12	4	3	1	75
Average of percentage of satisfactory recoveries				93.8
Deaths				5
Favorable results				88.8

From our observations of a study of 100 cases of pyloroplasty, we believe we are justified in drawing the following conclusions.

1. The operation has its greatest indication in the relief of pyloric stenosis due to chronic ulcers, situated at or near the pylorus, and on either side of it, or resulting from cicatricial contraction following the healing of such ulcers. It is often a useful procedure in cases of hæmorrhage due to gastric ulcers on the lesser curvature, or to duodenal ulcers which cannot be controlled medically, and which threaten the life of the patient, as well as in the chronic dyspepsias due to ulcers which have not been relieved by medical treatment.

2. The operation has certain advantages over gastro-enterostomy and but few of its disadvantages.

3. Such objections as are urged against the operation, e.g., its inapplicability in the presence of adhesions surrounding the pylorus, as well as in the presence of active and bleed-

ing ulcers, and also because of the fact that the new opening is not at its lowest point, taking advantage of gravity, are according to our experience more fanciful than real, since the operation has frequently been performed under these conditions with most gratifying results. The interesting experimental work of Cannon and Blake and others supports this contention.

4. The only contra-indications to the operation are inability to mobilize the duodenum when adhesions are too dense, and thickening and infiltration about the pylorus due to hypertrophic forms of ulceration. These conditions, however, in our experience occur but rarely.

5. In atony or gastroptosis with slight motor insufficiency such as is observed in the water-trap stomach; or in nervous dyspepsia, i.e., in gastric disturbances not dependent upon organic disease, this operation is contra-indicated.

6. The special advantages of this operative procedure lie in its affording the opportunity to excise all ulcers in the anterior walls of the stomach or duodenum after direct inspection of the part affected; also the application of treatment to ulcers situated in the posterior walls. It does not greatly disturb the normal relation between the stomach and intestines as is the case in other operations.

7. From our experience with the operation, the immediate as well as the final results are most encouraging. While in some instances partial gastrectomy or gastro-enterostomy is undoubtedly the operation of choice, nevertheless, on account of its simplicity and because of its satisfactory end results, we believe that pyloroplasty will continue to retain its position as a safe and useful procedure.

CLINICAL SUGGESTIONS BASED UPON A STUDY OF PRIMARY, SECONDARY (CARCINOMA?) AND TERTIARY OR MIGRATORY (CARCINOMA) EPITHELIAL HYPERPLASIA IN THE BREAST[1]

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THE writer's reasons for making the following contribution to the pathology and therapeutics of the breast may be briefly stated.

An examination of the literature reveals that there are at least 147 different terms which are utilized to express pathological mammary conditions. These are confusing to the great majority of practitioners, surgeons, teachers, and students. Many of these terms are synonyms, an example of which may be seen in the fact that there are twelve synonyms for the condition which Billroth and Koenig described as "mastitis cystica chronica."

The classifications which have been and are utilized are numerous and very different. This may be seen also in the fact that the best authorities disagree upon the character of such conditions as "cystadenoma," "abnormal involution," and "senile parenchymatous hypertrophy." These may be found described by some writers as benign conditions and by others as malignant conditions.

The clinical uncertainty which exists as a result of the confusion of terminology, the multiplicity of classifications, the divergence of operative advice from the general pathologist, and the lack of recognition of carcinoma as a part of an epithelial hyperplasia, have occasionally led to radical amputations of breasts unnecessarily, and also have allowed tumors which were clinically benign to remain in the presence of a possibility of malignancy.

The fact that general pathologists have recognized only epithelial hyperplasia into the stroma as carcinoma has led to advice to

[1] Read before the Southern Surgical and Gynecological Association, Atlanta, December 16 to 18, 1913.

the surgeon which has often proved to be disastrous.

The dogmatism relative to the rôle which the very indefinite "basement membrane" has played, in being the histological arbitrary line of demarcation between benign conditions and malignant conditions, has often retarded surgical radicalism which is, with our present knowledge, absolutely necessary in the treatment of cancer.

These existing conditions have stimulated a series of investigations of the pathology of one thousand breasts. It has been thereby shown that there are three definite histologic pictures which form a logical basis upon which operative procedure may be carried out.

The mammary acinus (gland unit) (Figs. 1, 2, and 3) is composed of one row of columnar or cuboidal epithelial cells, which are the functionating or secretory cells.

These rest upon another layer of cells which are almost invisible in the normal breast, but which become prominent when there is a chronic inflammatory reactive process present (Fig. 3). These correspond to the so-called "stratum germinativum" of the skin, and are the cells which are the progenitors of the differentiated or secretory cells. They constitute the germinal cells of the epithelium of the breast. In the presence of chronic inflammatory reaction in the mammary, one or more of three histologic pictures (Figs. 2, 3, 4, 5 and 6) are seen, whether the condition be encapsulated or non-encapsulated.

When the differentiated cells (inner row) and the undifferentiated cells (outer row) are present, the histologic picture may be spoken of as *primary epithelial hyperplasia* (Figs. 2a and 3). When the differentiated cells are absent and there remain only the hyperplastic undifferentiated cells of the outer row, the condition may be referred to as *secondary epithelial hyperplasia* (Figs. 2b and 4). When the line of demarcation between the hyperplastic undifferentiated cells and the stroma is indefinite or absent and the epithelial cells appear in the periacinar stroma, the condition may be spoken of as *tertiary* or *migratory epithelial hyperplasia* (Figs. 2c, 5, and 6).

Primary epithelial hyperplasia represents the usual reaction in chronic mastitis and is not considered to be malignant.

Tertiary hyperplasia or migratory hyperplasia is the histologic picture of carcinoma.

Secondary hyperplasia is found described as "cystadenoma," "Schimmelbusch's disease," "Reclus' disease," "senile parenchymatous hypertrophy," "abnormal involution," etc. It may or may not be malignant, it is placed in a benign group by some authorities and in a malignant group by others.

The cells of the epithelium in this condition are often indistinguishable from the cells in tertiary hyperplasia, a characteristic which arouses a suspicion that the two conditions are intimately related if not a part of the same thing, namely, a malignant hyperplasia.

Without proof relative to the outcome in such a condition, one may state that secondary epithelial hyperplasia is a doubtful condition, a group which needs special attention during the next decade.

The practical application of a knowledge of the three apparent histologic stages of hyperplasia may readily be seen in the fact that the life history of the most common pathologic conditions in the breast depends upon epithelial hyperplasia.

Mammary pathological conditions divide themselves into two groups, i.e., an encapsulated group (Fig. 7) and a non-encapsulated group (Fig. 8).

The encapsulated conditions to which special attention has been given during this investigation are the fibro-epithelial neoplasmata, such as simple adenomata, adenofibromata, fibro-adenomata, and cysts, in all of which epithelial hyperplasia occasionally occurs in all three stages.

Of the non-encapsulated conditions the most common is chronic mastitis, in which primary, secondary, and tertiary hyperplasia are also frequently found in the same field of the microscope.

With the possibility of these conditions being present in cases in which the classic clinical signs of carcinoma are absent, the surgeon and the surgical pathologist must agree upon a scientific histological standard before any definite operative procedure will bring about scientific knowledge of prognosis.

THE MAMMARY GLAND.

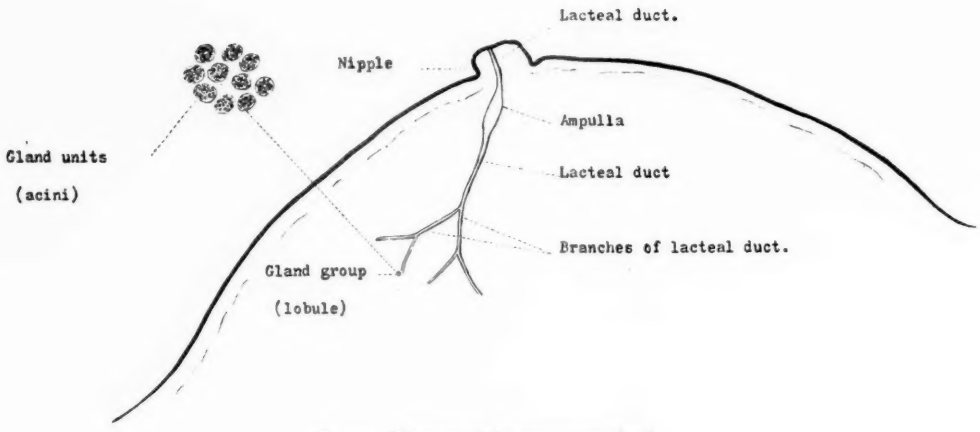

Fig. 1. Diagram of the mammary gland.

Primary epithelial hyperplasia (not carcinoma).

Secondary epithelial hyperplasia (carcinoma ?).

Tertiary or migratory hyperplasia (carcinoma).

Fig. 2. Diagram of the mammary acinus in, *a*, primary; *b*, secondary (carcinoma?); and *c*, tertiary or migratory (carcinoma) epithelial hyperplasia.

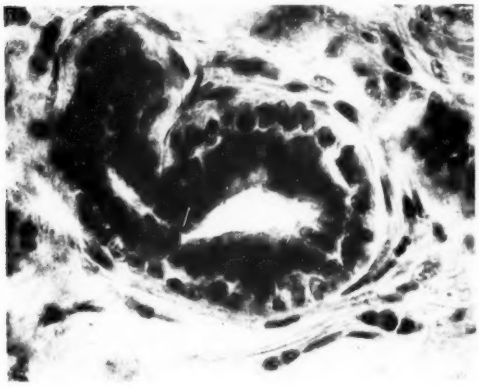

Fig. 3. Primary epithelial hyperplasia.

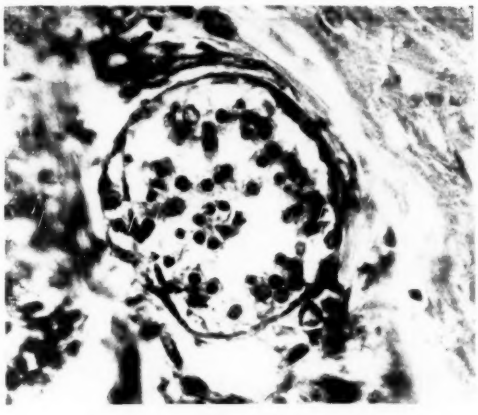

Fig. 4. Secondary epithelial hyperplasia (carcinoma?).

At present, surgeons have no very definite method or standard of dealing with the doubtful group. Radical operations are sometimes done when they are not needed, simply because the surgeon gives the patient the benefit of the doubt. The writer has occasionally seen carcinomata excised for benign tumors.

It seems that there should be a mean between the two extreme conditions, and this mean should, with the aid of a knowledge of the stages of epithelial hyperplasia, serve to scientifically solve the following problems:

1. The percentage of cases of tertiary hyperplasia with or without glandular involvement which may be cured after an arbitrary period of ten years from the time of radical operation.

2. The percentage of cases of secondary hyperplasia which will remain well or recur after the removal of the mammary gland itself without the removal of the glands, muscles, and large amounts of skin.

3. The percentage of cases with local chronic mastitides or encapsulated conditions which return later with secondary or tertiary hyperplasia after local removal.

The question for the surgeon to decide is whether or not he is willing to run the chance of local recurrence after wide local removal of a malignant condition followed by an exten-

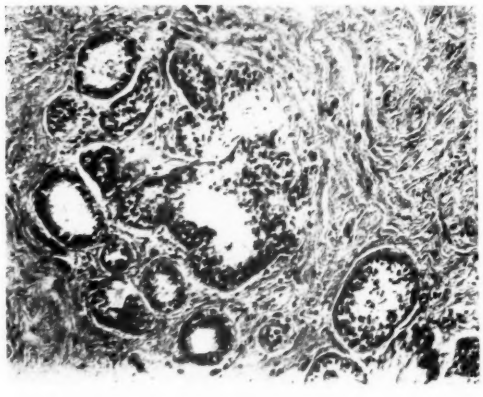

Fig. 5. Tertiary epithelial hyperplasia (carcinoma).

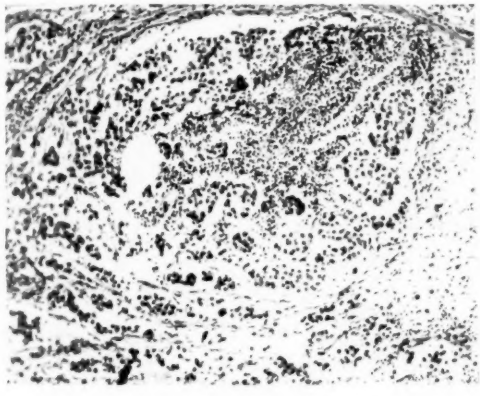

Fig. 6. Tertiary epithelial hyperplasia (carcinoma).

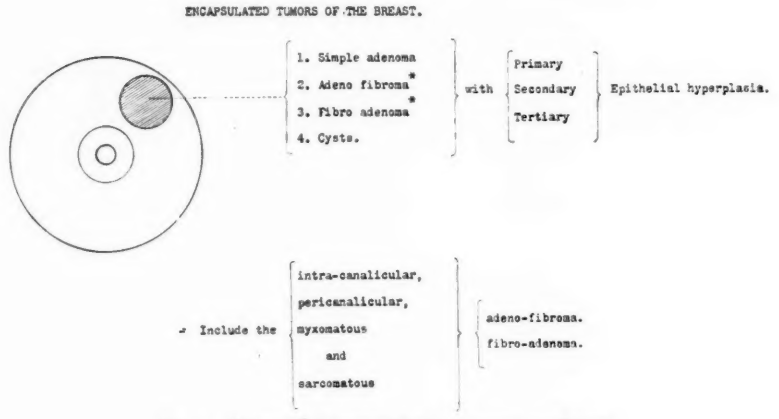

Fig. 7. Diagram of encapsulated mammary conditions.

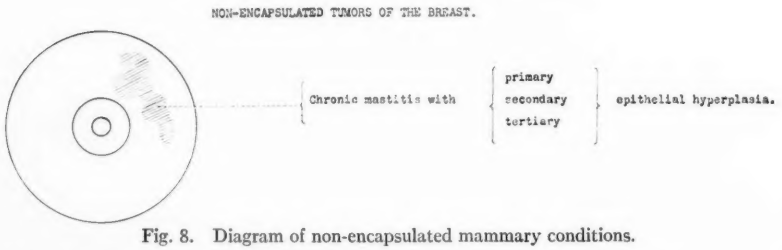

Fig. 8. Diagram of non-encapsulated mammary conditions.

sive operation after microscopic examination, or take the credit of doing radical operations unnecessarily in an attempt toward conservatism. This, with our present knowledge, can only be answered by conscience, and not by scientific data.

The plan which suggests itself to the writer, after an extensive experience with the pathologic conditions to be dealt with and also an intimate association with the activities of surgeons, seems to be based upon some known factors relative to the histology of epithelial activities and the fact that surgeons differ regarding the extent of operations necessary in the conditions which have been described above.

1. The conditions which are associated with classical clinical signs of carcinoma should be treated radically.

2. The doubtful cases in women near or over 35 years of age should have the entire mammary gland removed for immediate examination. If primary or secondary hyperplasia be present, nothing more should be done; if tertiary hyperplasia be present, a radical operation should be performed.

3. In doubtful patients near or under 35 years of age, a wide section of the mammary gland including the pathological conditions should be removed for examination. If primary hyperplasia be present, nothing more should be done. If secondary hyperplasia be present, the rest of the mammary gland should be removed; and if tertiary hyperplasia be present, the radical operation should be accomplished.

This plan avoids incision of tumors. It removes the possibility of unnecessary radical operations and their physical and psychical embarrassment. It provides for a scientific means of determining more accurately the stage at which cancer may be cured by surgical operations and the extent of the operation which is necessary to effect such a cure.

In the experience of this clinic the removal of the mammary gland preceding an immedi-

ate radical operation has not been associated with earlier recurrence that has been found after a primary radical operation.

The plan is herewith presented with the realization that it is a conservative experiment which is based on scientific facts. It is based upon actual research upon each specimen, and is free from the incumbrances of extensive terminology and dogmatism relative to which specimen is and which is not carcinoma.

It presents a means of actually determining what is clinically malignant.

It makes the surgeon an essential factor in the study of the biology of the epithelial cells and their relation to cancer. It will save many patients from unnecessary mutilation and will give radicalism its proper place in the treatment of cancer of the breast.

END-RESULTS IN OPERATIONS FOR CANCER OF THE BREAST[1]

By E. S. JUDD, M. D., assisted by W. E. SISTRUNK, M. D., Rochester, Minnesota

THE following is a review of the results of operations in our clinic for cancer of the breast from January 1, 1902, to January 1, 1912.[2] It was originally intended to report all the cases of mammary cancer that had been operated on more than three years earlier, but in spite of the fact that we have endeavored for several years, through correspondence and personal communication, to complete our post-operative records, so far accurate data in many of the earlier cases have not been obtained. It seems best, therefore, to make this report cover the results of the ten consecutive years up to two years ago, of which we have fairly correct knowledge, hoping to be able to complete the data on the earlier cases at some future time.

Previously, it was customary to allow three years to elapse before making claims of a cure following an operation for cancer. It is undoubtedly true that many patients who pass through the first three years without recurrences do remain well, but it is also true that a certain percentage of them have recurrences and metastases at a period much later than three years. In view of this, it is difficult to say how much time should elapse before a patient operated on for mammary cancer may be said to be cured.

It is impossible to state what course these cases would have taken had they not been operated on, but, judging from the histories of similar though non-operated cases, it is fair to assume that a goodly proportion of those operated on reasonably early have either been cured or at least have had an extension of life and a comfortable existence for many years. "Cases not operated on prove fatal, on an average, in 20 to 28 months, the extremes varying from less than two months to more than 20 years:" Finney.

The cases upon which our study is based are consecutive cases, and none have been omitted from which post-operative data were obtained. Many operations were known at the time to be palliative, and were performed because of ulceration or the patient's extreme suffering. Many times these palliative operations were satisfactory, bringing relief and apparently prolonging life.

The principle in the technique of all the radical operations was practically the same, and consisted in the removal of the entire breast, axillary glands, and fascia, including the pectoralis major and minor muscles in every case. These structures were usually all removed in one piece. In the evolution of the operation, the tendency in the later years has been to remove more widely the subcutaneous and deep fascia in all directions. In some cases it has been necessary to skin-graft the wound in order to close it, though in most of our cases we have been able to suture the skin flaps directly. In many of the cases we employed technique as suggested by Jackson

[2] These operations were performed by C. H. Mayo, E. H. Beckman, E. S. Judd, and D. C. Balfour.

[1] Read before the Southern Surgical and Gynecological Association, Atlanta, Georgia, December 16 to 18, 1913.

and also by Rodman, and have found their methods very useful.

It has not been our practice to remove the fascia and glands from above the clavicle. If these glands are palpable, one is removed for microscopic examination, to determine the nature of the enlargement. If the supraclavicular glands prove to be involved, it has usually been our experience that the individual lives longer and more comfortably if not operated on. In some cases, however, especially when the lesion in the breast is in one of the upper quadrants, and especially if there be attachment to the skin, we believe that it is advisable to continue the dissection of the fascia and glands to the supraclavicular region. In most cases in which the glands were involved the individual has not lived three years. In one of such cases, however, the glands showed definite cancer, and the patient is now living (more than five years) without recurrence.

The diagnoses in all these cases were made from both macroscopic and microscopic evidence. During the ten years from January 1, 1902, to January 1, 1912, we have operated on 609 patients with cancer of the breast; of these 607 were females and two were males. One of the males is alive without recurrence three years following the operation. The other male died at the end of two years and eight months, from recurrence.

Of the 609 cases, we have been able to trace and have fairly accurate knowledge of 514. No patients in this series died in the hospital, though three died within one month after the operation. Patient No. A7541 died at the end of two weeks, when the wound was well healed; the autopsy in this case showed a large pulmonary embolism as the cause of death. Patient No. A46874 died at the end of the fourth week, in diabetic coma. The wound had healed and the autopsy showed no carcinoma. Patient No. A22134: Wound did not heal, patient developed septic phlebitis, dying at the end of fourth week from sepsis.

In estimating the age incidence of carcinoma of the breast, we found that the youngest patient was 25 and the oldest 85 years of age. Estimating the number of cases occurring in each decade, we find:

TABLE I

20 to 30 years of age	13 patients
30 to 40 years of age	147 patients
40 to 50 years of age	228 patients
50 to 60 years of age	147 patients
60 to 70 years of age	88 patients
70 to 80 years of age	27 patients
80 to 90 years of age	1 patient

In one patient 26 years of age, a tumor in the lower inner quadrant of the right breast was supposed to be benign, but at the time of removal it proved to be cancer. The wound was packed with gauze saturated with Harrington's solution, and two days later a radical operation was performed. This patient is alive and without recurrence seven years and nine months after the operation.

One patient, 25 years of age, whose tumor was diagnosed as malignant intracystic papilloma, at the time of the operation was nursing a 9-month-old baby. She is alive without recurrence more than six years later.

One patient, 28 years of age, with carcinoma of the left breast and concerning whom the prognosis at the time of operation was considered good, except for her age, is well now after three years and three months.

One patient, 26 years of age, diagnosed as early cancer of left breast, is alive with questionable local recurrence two years and nine months after operation.

One patient, 28 years of age, with cancer of the right breast and axillary glands, recurring after a partial removal of the breast elsewhere one year before, is alive without recurrence two years and nine months after operation.

These cases are mentioned especially to show that mammary cancer in a young person is not necessarily hopeless, and that a good percentage of the cases coming for treatment early may be relieved for a long time, and that even in recurring cases a fair result may sometimes be obtained.

As will be seen from the table, many of our cases have occurred in the so-called cancer age — 40 to 50 years — and by far the greatest proportion between 30 and 60 years. Nearly all the younger patients who remained well have been those who came for treatment early, before there was any evidence of extension to the lymphatics.

TABLE II

Percentage of deaths according to ages

	Ages	Based on number of patients heard from. Died within 1 yr.	Died within 3 yrs.	Died wthin 5 yrs.	Died after 5 yrs.	Alive 2 to 10 yrs.
Total preclimacteric periods	20–30	0	0	0	0	5 pat's
	30–40	20%	46%	55%	1%	43%
		19%	43%	52%	1%	47%
Total climacteric periods	40–50	20%	45%	50%	5%	43%
	50–60	16%	45%	57%	1.8%	41%
		19%	45%	53%	4%	42%
Total post-climacteric periods	60–70	16%	37%	44%	7%	43%
	70–80	7%	50%	50%	7%	43%
	80–90	0	0	0	0	1 pat.
		13%	39%	45%	7%	48%

In Table II may be seen the percentage of cases for each decade who have died within the first year after operation. We cannot explain why the younger patients have apparently done better than the older ones, except that the great majority of them came for treatment early.

TABLE III

Results in patients operated on over periods of three years

510 patients operated on more than three years.
427 patients have been traced.
234 patients have died.
191 patients are living.
44.7 per cent of patients have lived more than three years.
27 of these patients have recurrence at the present time.
19 patients died from other causes.

Of the 514 patients whom we have been able to trace, 266, or 51.7 per cent, are known to be dead. Twenty-one of these died from other causes, without clinical signs of recurrence. On several of these patients autopsies were performed and no recurrence was found. Subtracting these from the number who have died from cancer leaves 47.6 per cent of deaths from cancer for the entire series. Of the 514 patients 248 are known to be alive from two years to eleven years and four months. Thirty-seven of those living are known to have recurrences.

In 1902, 24 patients were operated on. Of those operated upon more than 11 years, we have traced 19: 15 have died from various causes and 4 are alive and have no recurrences. Thus, 21 per cent of this series are now alive, after more than eleven years, and without recurrence. In each of these patients the carcinoma was in the left breast. The axillary glands were enlarged in two of them. One of this series who died had had a fairly radical operation elsewhere twelve years before. She came to us with recurrence in the skin and axilla. This was removed and she lived two years and two months following this operation. One of these early patients lived six years and nine months after the operation, and died of arteriosclerosis, without evidence of recurrence. One other lived six years without local recurrence, and died of metastases in the liver.

Twenty-six patients were operated on in 1903. Of this group we have been able to trace 21, and 43 per cent are alive without recurrence. All of these patients have lived more than ten years. Two in this series had been operated on for malignant disease in other organs. One patient had had a hysterectomy for carcinoma of the uterus two years before, and one other had been operated on three months before for malignant papillary ovarian cysts.

Patients living more than ten years. Of the patients operated on during the years 1902 and 1903 we have been able to trace 40; of these, 27 are known to be dead from various causes, which leaves a percentage of 32.5 per cent alive without recurrence more than ten years. Three of the patients who died lived more than six years, and died from other causes.

Patients living more than five years. Of the 321 patients operated on more than five years, 266 have been traced. Of these 148 are known to be dead and 106 are living, thus giving a percentage of 39.8 living more than five years. Six of these patients have recurrence at the present time. Fourteen included in these deaths have died from other causes.

Patients living more than three years. Of the 510 patients who have been operated on more than three years, 427 have been traced; 234 are dead and 191 are living, leaving a percentage of 44.7 of patients living more than three years. Of these, 27 have recurrences at the present time; 19 are known to have died from other causes.

Late recurrences. We have also in this series several who have died from carcinoma

after being free from it for a number of years. In one instance the patient died nine years and one month after the operation from general carcinosis. One had metastases in the lungs five years and eleven months after operation. One had internal metastases in the liver six years and four months; another had metastases without any local recurrence, and died six years and five months after operation. In one instance we operated for recurrence twelve years after the primary operation, the patient remaining well nearly three years after the secondary operation.

We have known for some time that late recurrences occur following operations for carcinoma of the breast, but we have been rather surprised to find so many patients with late recurrence. In reviewing the literature on this subject, we have found one case reported by Matas with recurrence nearly 25 years after the first operation; and another reported by Ransohoff in which there was recurrence nearly 20 years after the primary operation.

Our statistics do not bear out the supposition that excision of the tumor or a part of the breast, followed by a radical operation within a few days or weeks, means always a bad prognosis. For example, in one of our cases the breast was removed for supposed mastitis. This was found on examination in the laboratory to be carcinoma. It is our custom in such cases to arrange for an immediate radical operation in all instances if it is found to be necessary. In this particular instance, however, the radical operation was not performed until seventeen days after the incomplete operation. This patient is now living without signs of recurrence seven years and nine months after the operation. In another case, a specimen had been removed one week before the patient came to our clinic, and at operation definite carcinoma of the breast was demonstrated. This patient at the present time is alive and free from recurrence, six years and two months after the operation. In one other case which is still more striking, the patient's breast was removed elsewhere four years before. Some weeks after this operation she developed nodules in the axilla. These were treated by X-ray over a period of some months. We removed the recurrent masses, and she has been living now six and a half years without further evidence of cancer.

On the other hand, we have had five cases in this series in which specimens had been removed elsewhere from three weeks to one year before our radical operation, and all these patients died, from two months to two and one-half years later.

We have had several patients in whom both breasts were involved. If both were involved at the same time, the prognosis as a rule was bad. If one had been removed and there was recurrence later in the other breast, the prognosis was often quite favorable. In 1905 we operated on a patient whose opposite breast had been removed in 1899. She lived four years eight months after the second operation.

In 1906 we operated on two patients in whom there was a very small lesion in the breast, and no glandular involvement could be found. Macroscopically and microscopically the diagnosis was early carcinoma, and we believed both were favorable cases. Both of these patients had early metastases, and one died within two years. These two patients seem to illustrate a certain group who in all probability, at the time of operation, have internal metastases or extension to the mediastinal glands without evidences of such extension. We have seen several hopeless cases because of metastases to the liver, spine, or bones, and yet in which the primary focus was small and free, and no enlarged glands could be felt.

We have also observed two such patients with pathological fractures of the femur. In both of these the fractures occurred five years after the operation. Metastasis to the bones has not been common, though many of the replies to our inquiries would indicate involvement of the vertebræ. Involvement of bone is usually late.

We have considered œdema in the tissues as a contra-indication to operating, because we believed that the lymphatics were all blocked by the extension of the cancer. One of these patients, in whom the prognosis was bad because of œdema and who was operated on as a palliative measure, is yet alive without recurrence five years and three months later.

Cancer in the lactating breast has been most unfavorable. Of the three patients operated on, two have died within the first year; in the one exception, the growth was an intra-cystic papilloma.

TABLE IV

Results in patients operated on over periods of five years

321 patients operated on more than five years.
266 patients have been traced.
148 patients have died.
106 patients are living.
39.8 per cent of patients have lived more than five years.
6 of these patients have recurrence at present time.
14 of these patients died from other causes.

TABLE V

Results in patients operated on over periods of ten years

50 patients operated on more than ten years.
40 patients have been traced.
27 patients have died.
13 patients are living.
32.5 per cent of patients have lived more than ten years.
None of these patients have recurrence at the present time.
3 patients died from other causes.
All of these three patients lived more than six years.

TABLE VI

Number of cases and percentages for each year

Year	No. of Cases	Traced	Dead	Alive, no Recurrence	Alive, with Recurrence	Alive, no Recurrence	Alive, with Recurrence
1902	24	19	15	4	0	21%	
1903	26	21	12	9	0	43%	0
1904	32	24	14	10	0	41.7%	0%
1905	51	43	23	18	2	41.8%	46%
1906	57	51	34	17	0	33⅓%	0%
1907	62	50	28	20	2	40%	44%
1908	71	59	34	23	2	39%	42.3%
1909	94	70	42	29	8	36.7%	46.8%
1910	95	82	34	35	13	42.7%	58.5%
1911	97	86	30	46	10	53.5%	65%

Functional result. Special inquiry has been made regarding the ability to use the arm and shoulder following these operations, and a very large percentage of the patients have reported that their arms are all right or practically as good as ever. We have noticed that when it is necessary to destroy one of the motor nerves the function is much more apt to be impaired. Pain in the arm is usually complained of shortly after operation, but in most of our cases this entirely disappears within two weeks. We have made special inquiry regarding œdema in the arm. Occasionally the swelling and œdema has been marked. Counting the patients with the œdema and those who say they have some swelling of the arm at times, the entire group is not over 5 per cent. The œdema, as we have seen it, occurs in two ways: first, as primary œdema immediately following the operation. This is quite common, and we believe it is due to a thorough removal of the lymphatics; it persists until collateral circulation in the lymphatics has been established. This is usually a matter of two or three weeks, and can be relieved by early exercise and massage. Second, are those patients in whom the œdema comes on late, several months or years after the operation. Here it is due to a recurrence of the carcinoma in the remaining lymphatics, which have been draining the arm, and of course is permanent. In four patients we have removed the entire axillary vein down to the cephalic vein, taking care that the latter was not injured. The resulting œdema was but slight and temporary. Even with the removal of the pectoral muscles, intercostals, part of the latissimus dorsi and serratus magnus, and all of the axillary fascia and lymphatics, in many of these cases the function of the arm and shoulder has been impaired very little.

CONCLUSIONS

1. Results in operations for cancer of the breast are as good as if not better than results in operations for cancer elsewhere.

2. The prognosis in younger people who received the benefit of an early operation was better than we had expected.

3. The prognosis is variable in a certain per cent. An extensive external involvement may give a fair prognosis, while a slight external lesion may terminate early from internal metastasis.

4. That metastasis may occur many years after the operation, though in the great majority of instances it will appear in the first few years, if at all. The difference

between the percentage of patients living more than three to five and ten years is not as great as might be expected; but this is because most patients who die of the disease die within the first three, or at least the first five years. Living five years without recurrence is an indication of but slight trouble in the future.

5. Comparing these results with those of former years, we feel that the results are improving, and that the improvement seems due to the fact that patients are coming earlier rather than to any improvement or change in the technique.

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GASTRIC HÆMORRHAGE[1]

BY JOHN B. DEAVER, M. D., PHILADELPHIA

GASTRIC hæmorrhage or the copious effusion of blood into the stomach is, as a rule, followed by hæmatemesis, and results from a number of disturbing factors in the mechanism of the upper abdominal circulation. In the minority of cases the blood is not at once ejected, but is passed subsequently by the bowel in the form of tarry stools. Cases of gastric hæmorrhage fall into two groups, the surgical and the non-surgical or medical. It is as great a mistake to operate on non-surgical cases as it is to withhold operation in surgical bleeding. The exploratory operation, therefore, is not available for diagnosis, and successful treatment demands a high degree of diagnostic skill in deciding for or against operation.

It is well to bear in mind that blood which is vomited does not always mean gastric hæmorrhage. The older clinicians called forcible attention to hæmatemesis as a symptom of hæmorrhage from the pharynx or respiratory tract, the blood being swallowed and later vomited. I have seen profuse hæmatemesis in hæmorrhagic inflammation of the biliary tract, the blood having reached the duodenum through the common duct and then regurgitated into the stomach. The primary cause in this case was acute streptococcic cholecystitis. One case of carcinoma of the jejunum was characterized by profuse hæmatemesis. Profuse hæmorrhage from a duodenal ulcer not infrequently is carried backward into the stomach, and after a gastro-enterostomy a marginal or jejunal ulcer may bleed into the stomach. The examination of all the rare causes of hæmatemesis would serve here no useful purpose. Most often, true gastric hæmorrhage is due to ulceration of the stomach. The ulceration may be due to malignant disease or to a benign process. It may be acute or chronic, superficial or deep, large and extensive or microscopically small.

Profuse and even fatal hæmatemesis without demonstrable ulceration of the stomach has been observed in a considerable number of cases, both at autopsy and at operation. Dieulafoy has described a variety of hæmorrhage due to the formation of minute mucous erosions, single or multiple. Such erosions have been observed as linear or stellate fissures in the act of bleeding during operation. Paterson reports a case in which no visible erosions were present, but a raised vividly red patch of mucosa the size of a half-crown was seen to be oozing blood. I have observed a case by gastrotomy in which the whole mucosa was intensely red and thick and bled at the slightest touch. Such a condition I am inclined to consider as a hæmorrhagic gastritis, and it is probable that it is the result of an intense acute infection of the mucosa, though it may be due solely to an unknown toxic cause. Of 459 of our

[1] Read before the Clinical Congress of Surgeons of North America, Chicago, November 11, 1913.

cases of upper abdominal disease, hæmatemesis occurred in only 25 per cent, and 20 per cent of these cases were either simple ulcer or cancer of the stomach.

Vicarious menstruation as a cause of hæmatemesis is an absurdity of the medical imagination, more fertile in hypothesis than wise in the knowledge of living pathology.

A knowledge of the hæmorrhagic possibilities of active congestion of the gastric mucosa cannot be learned at the mortuary slab, but only by witnessing its bleeding surface in the living.

The touch of the surgeon during life, as Mayo has so well said, has revealed that which post-mortem pathology has overlooked. Profound knowledge of the pathological anatomy of the conditions giving rise to gastric hæmorrhage is only gained by autopsy *in vivo*, which knowledge is as essential to the making of a diagnostician as it is to go into the water to learn to swim. Internists will never be alive to the possibility of ulcerative pathology until they have been made familiar with an eye demonstration in the living subject.

Excepting extrinsic poisons, I believe this violent congestion of the gastric vessels is primarily dependent upon an intra-abdominal or more rarely a remote focus of infection. I believe, further, that the atrium of infection in these cases is most commonly the appendix, the gall-bladder, the fallopian tube, and more rarely some other storehouse of bacterial growth. This variety of acute massive hæmorrhage from the gastric mucosa without evident ulcer occurs most often in young females. Exceptionally it has been noted in males and at the older ages. It is distinguished chiefly by the age and sex incidence, by the suddenness of onset and freedom of the hæmorrhage, by the usual absence of previous ulcer symptoms, and by spontaneous recovery in the majority of instances. Mansell Moullin, in 1907, stated that he had observed 153 cases of hæmatemesis due to supposed gastric ulcer occurring in females under 30 years of age, with only one death. He believed his experience was exceptional in respect to mortality, but Bramwell, in almost as large a series of cases belonging chiefly to this group, experienced a mortality under medical treatment of only 3 per cent. Hale White has reported 29 cases of hæmatemesis in which post-mortem examination revealed no gastric lesions, and suggested for the condition the name gastrostaxis. Dawson contributed two cases, and preferred the term hæmorrhagic gastralgia. While I have never operated upon this condition during acute bleeding, it has fallen to my lot to explore the stomach in a number of cases in which a history of hæmatemesis and some sort of indigestion had indicated the probability of ulcer, without being able to demonstrate any lesion, past or present. Even allowing for the well-known difficulty of demonstrating erosions or fissures by operation or autopsy, I believe it is clear that there is a hæmorrhagic disease of the stomach which is not any form of gross ulcer and probably is not closely related to it. Bramwell gives a suggestive case of hæmatemesis in which the underlying condition of vegetative endocarditis gave little indication of its presence during life. It appears to be clear also that the toxic or infective influences which cause this variety of hæmatemesis are not materially improved by operation upon the stomach. In ten cases of acute hæmorrhage in which no lesion was demonstrated at operation, there was one operative death and two cases of recurrence of bleeding. We must, therefore, yield to the results of experience and eliminate this group from operative endeavor.

The condition of mucous erosions described by Dieulafoy has been established as a true pathological condition by the actual observation of such erosions in the form of linear or stellate fissures in the act of bleeding during operation. Whether this condition stands most closely in relation to hæmorrhagic gastritis or to acute peptic ulcer, it is not yet possible to determine. Clinical evidence does not suffice, and living pathology has not yet dispelled the mystery. Such erosions may bleed furiously, even to the point of exsanguination and death. In the past ten years I have found in the literature six such patients treated by gastrotomy and ligature of bleeding points of the mucosa. In one case a gastrojejunostomy was added. There

were no deaths; but the number of cases is small, and it is hard to resist a feeling that in view of the diffuse nature of the disease the recoveries that followed such simple measures cannot justly be given too large a measure of credit. It is highly probable, moreover, that at least a percentage of cases regarded as gastrostaxis belong in this group. I have operated upon six cases in this group without mortality. The operations were gastrotomy for exploration, gastrojejunostomy, and plication of the duodenum for relief. The immediate results were excellent, but I have not been able to follow all of the cases. My belief in the necessity of the operation in this class of cases has been considerably undermined by the good results of medical treatment. I do not believe that gastrojejunostomy should be performed in the absence of gross gastric lesions.

Hæmorrhage, more or less acute, may result from the formation of the typical acute peptic ulcer, the vessels beneath the muscularis mucosa being opened by the ulcerating process. Such hæmorrhage is rarely fatal, the vessels opened being small and their walls still soft and normal, permitting retraction and contraction with the formation of an occluding clot as the blood pressure is reduced by hæmorrhage. In many cases acute ulcer announces its presence by bleeding, and if appropriate measures are taken the hæmorrhage is rarely dangerous and seldom repeated.

In chronic ulcer, as pointed out by Fenwick, the vessels eroded may be larger, and as a result of the sclerosing inflammatory process which has preceded the actual erosion, the vessel wall is rigid and incapable of contraction. Hæmorrhage from this source, therefore, is apt to be free, and if stopped temporarily by the fall of blood pressure and clot formation, it is prone to recur from digestion of the clot and advancing erosion.

While it is true that sudden massive hæmorrhage does occur in chronic gastric and duodenal ulcer, it is also true that it is not a characteristic of ulcer to bleed profusely. Occult blood or small recurring hæmorrhages are far more characteristic of ulcer, and it is therefore incumbent upon the diagnostician, in the presence of diffuse hæmatemesis, to adduce considerable evidence in the way of history or examination before concluding that ulcer is present.

Sudden profuse hæmorrhage is more characteristic of ruptured varix than of gastric ulcer. Varicose veins about the cardia have long been known as a condition associated with cirrhosis of the liver, and are likely to cause death by sudden rupture. This condition is met with chiefly in males who are or have been addicted to the habitual or excessive use of alcoholics. Indigestion is a common complaint in cirrhosis, but it is rarely of the ulcer type. The distinguishing feature of this hepatic indigestion is a feeling of fullness in the upper abdomen, a feeling of constriction, which is constant but much increased after the ingestion of meat. This is not associated with pain simulating ulcer, with any evidence of gastric fermentation, with eructations of gas, or with any suggestion of alteration in the motility of the stomach. This is simply the subjective impression of an overdistended portal circulation analogous to the gastric discomfort of non-compensated lesions of the mitral valve. On the insistence of three medical colleagues, I recently operated upon a middle-aged man whose recital of this symptom, rather than the associated hæmatemesis, led me to disagree with their diagnosis of duodenal ulcer. This patient's history lacked the pain typical of ulceration; indeed, there were few symptoms, except several attacks of hæmatemesis and the peculiar hepatic indigestion to which I have referred. Operation showed a cirrhotic liver — not ulcer. Ten days after the operation the patient succumbed to a fatal hæmatemesis. Autopsy revealed a perforated varicose ulcer of the lower end of the œsophagus. Cases are occasionally met with in which none of the usual etiologic factors of cirrhosis exist, and the signs may be no less obscure. Taylor has reported such a case, in which gastro-enterostomy was done in the belief that ulcer existed. There was slight temporary improvement, followed by recurrence of the bleeding and death. Not long ago a similar case came to us for hæmatemesis, who had had a gastro-enterostomy

done previously by one of my Philadelphia colleagues. I refused to operate, believing the case one of cirrhosis. Patient recovered and has since been at the hospital for similar attacks. I have found no cases in the literature in which a gastric drainage operation has benefited, for any appreciable length of time, the hæmorrhage due to cirrhosis of the liver. The cirrhotic is a poor subject for surgery, even exploratory, and the futility of surgery in the emergency of hæmorrhage from œsophageal varices is the cause of considerable chagrin to the surgeon who opens the abdomen for the cure of this variety of hæmorrhage. Of 149 cases of cirrhosis of the liver admitted to the medical wards of the Episcopal Hospital of Philadelphia, 6 per cent gave a history of bloody vomitus.

The hæmorrhage due to malignant disease of the stomach, like that of ulcer, is not commonly sudden and profuse. In the early stages it is slight, even occult in the stools. It is more likely to be persistent than the hæmorrhage of ulcer, and tends to become progressively more marked. The hæmorrhage from malignant ulceration is, as a rule, a slow seepage which gives rise to little systemic effect of bleeding, but reveals itself by the process of coffee-ground vomitus or melæna. Sudden hæmorrhage is one of the modes of termination of gastric carcinoma, but in all but the rarest instances such an event is but the termination of an already established and evident malignant cachexia.

When hæmorrhage is a result of neoplasm it is rarely remediable by surgery, though occasional success may be attained in the case of slowly metastatizing malignant growths or in ulcerated benign tumors of the stomach. During the past year there occurred in the practice of one of my Philadelphia colleagues a case of death from hæmorrhage of an ulcerated myoma of the stomach. The growth was round, encapsulated, and about 6 cm. in diameter, and its growth was chiefly inward into the cavity of the stomach, much like a submucous myoma of the uterus. On the innermost surface a typical punched-out round peptic ulcer had formed, from which successive hæmorrhages reduced the patient to a condition of such anæmia that the case was regarded as one of the pernicious variety, with bleeding from the mucosa of the intestinal tract. Autopsy revealed a tumor of the gastric wall, easily capable of excision.

Gastrorrhagia dependent upon blood dyscrasias must be kept in mind, although they rarely offer serious difficulties in diagnosis. Our understanding of active blood vascular congestion as a cause of profuse hæmatemesis is one of the monumental gifts of living pathology to clinical surgery.

Operation may be indicated in gastric carcinoma when hæmorrhage chances to be an early symptom and there is still hope of cure; or it may be indicated in advanced or otherwise inoperable cancer when hæmorrhage is so profuse and persistent as to shorten even the period of prognosis given to cancer. In this case the measures to be adopted are: excision, gastro-enterostomy, or jejunostomy, in accordance with the pathology found at operation. Kammerer has reported a case of gastric carcinoma with profuse hæmorrhage in which gastrojejunostomy stopped the bleeding and the patient lived almost a year. Tixier records a similar case in which hæmatemesis ceased after gastro-enterostomy, and he was able a month later to resect the growth. In my opinion, appropriate cases of this sort will be excessively rare, as I am greatly opposed to operations being done on cases which are inoperable from the standpoint of cure. I have seen too many instances where the expected benefit failed to materialize and the last state of the patient was worse than the first. And even in the case of temporary improvement, the subsequent disappointment is often but the more keen. The true interests of surgery, also, are retarded by what the laity considers a failure of our art, and attention is diverted from the crux of the question, namely, early diagnosis and treatment.

It would seem to me that sufficient observations have been accumulated concerning the prognosis of gastric hæmorrhage not due to trauma, with or without operation, to confine the indications for operation to one group of cases, namely, chronic benign

ulcer. It is beyond doubt that lives have been saved by surgical intervention in chronic ulcer. That the chronic ulcer which slowly erodes its way into an important vessel will, in the majority of instances, cause fatal hæmorrhage is established by clinical and pathological evidence. But four most essential questions remain to be settled: (1) The recognition of suitable cases; (2) the time to operate; (3) the type of operation to be performed; (4) the proof of our position by mortality statistics.

1. The diagnosis of chronic eroding ulcer must be clear to warrant operation in acute gastric hæmorrhage. Not only must the conditions which simulate it be considered and eliminated so far as possible, but we must be in possession of a history which points strongly toward the existence of chronic ulcer. The most important point is a history of long continued, persistent, painful indigestion definitely related to the ingestion of food. There should be a certain irregular periodicity, but the intervals of freedom from symptoms should be only weeks, not months or years. The methods of relief from pain are often important. The constant use of alkaline remedies, of additional food when pain comes on, of gastric lavage, point toward ulcer. In some cases small hæmorrhages have occurred previously, and in some fortunate cases the patient has already had a well-founded diagnosis of ulcer made by his medical attendant.

The surgeon must not be considered as the mechanician only, but particularly as the master diagnostician, made such by frequent excursions into the pathological fields with which the abdominal cavity is too often so rich. Like the internist, the surgeon must not pin his faith in obscure cases to the bismuth meal, the X-ray, and the fluoroscope, but to the aseptic scalpel which makes the abdominal wall transparent.

Granted that we are in the presence of an acutely bleeding chronic ulcer, when should we operate? Many of these hæmorrhages are so rapid and alarming that the patient when first seen is practically exsanguinated. Savariand stated that 18½ per cent of the victims of hæmorrhage died before operation was possible. In many others hæmorrhage ceases just short of death. It is manifestly improper to attempt operation in acute collapse. Surgical judgment must be invoked to determine the possibility of successful operation, and in general it is my opinion that we should err on the side of conservatism. As Paterson has pointed out, the low blood pressure and collapse of hæmorrhage is favorable for arrest of the bleeding but unfavorable for surgical intervention.

General measures for the treatment of internal hæmorrhage should be rigidly applied. Morphia hypodermically is the most valuable. Absolute quiet is essential. The foot of the bed should be elevated. Nothing, not even ice or a drop of water, should be given by mouth. Saline solution should be given by rectum, or in greater emergency by hypodermoclysis or intravenously. If death is not too imminent, fluid should not be supplied too quickly lest it raise the blood pressure, dislodge the clot, and favor further hæmorrhage by the dilution of the serum. The return of the patient to a normal circulatory condition should be carefully watched. In this point I would differ from the majority who wait for further hæmorrhage before deciding to operate. The shock of even a moderate acute hæmorrhage is temporarily great, but may be quickly recovered from. If we have the diagnostic evidence of chronic ulcer, it is at this point that operation should be undertaken. A second hæmorrhage is far more depleting than the first, and, moreover, throws but little light upon the pathology, which is the essential point at issue, since recurrent hæmorrhages are common in the other varieties of gastric hæmorrhage.

The chapter on the methods and results of operation we must all unite in making. The ligature remains the premier method of hæmostasis, but the advisability and necessity of its application in profuse intragastric bleeding becomes a matter of most refined discrimination between the several causes of such bleeding.

It is true these are rarely surgical emergencies in the sense that ruptured ectopic pregnancies are emergency cases, but to withhold the aseptic scalpel in a definite

proportion of these cases is a practice as erroneous as the gynecologic suggestion to await reaction in the dying woman. My experience has been fortunate in operative cases. I have operated upon 10 cases of acute gastric hæmorrhage. In 2 cases I excised the ulcer by pylorectomy; one recovered, one died. In 3 cases of duodenal ulcer I made a posterior gastrojejunostomy and plicated the duodenum over the ulcer. All recovered. Five cases of pyloric ulcer were treated by simple gastrojejunostomy. All recovered. Two cases of hæmorrhage have died in the wards during the past six years while reaction was awaited. In one the coronary artery was eroded, in the other the gastroduodenal was opened.

In reviewing the literature during the preparation of this article, 33 cases of operation for acute gastric hæmorrhage, exclusive of my own, were collected since the independent reviews of Tuffier and Connell in 1905. In these 33 cases there were 8 deaths (24.2 per cent). This is to be compared with Tuffier's collective mortality of 36.3 per cent in 1905, with Rodman's mortality of 37.5 per cent in 1901, and with Savariand's figure of 62.6 per cent in 1898.

It is easily seen that the mortality is continually becoming less, a fact attributable, doubtless, to various causes, but in part at least to increasing accuracy of recognition of the proper type of cases in which surgery is to be employed. May we not hope that our skill in diagnosis and resources of treatment may be so increased that we may be able to select and save a greater percentage of those who are seized with sudden gastric hæmorrhage? Many problems remain for surgical solution, but it must be our constant aim to build a symptomatic superstructure on the foundation of our knowledge of the living bleeding tissues. In this wise we can guide aright the steps of professional judgment, crippled with that irrationality inseparable from terminal or dead pathology.

ON THE ETIOLOGY AND BACTERIOLOGY OF LEUCORRHŒA[1]

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OUR knowledge of leucorrhœa is unsatisfactory and incomplete. The majority of physicians neither appreciate the gross aspects of the condition nor discover the locality from which discharges arise, practically none of us possesses an adequate knowledge of the bacteria involved, and most clinicians admit that their curative efforts yield poor results.

This study was begun with the desire to learn more about the factors concerned in leucorrhœa, with especial reference to bacteriology, in the hope of thus leading to new principles in treatment.

The work includes the following subdivisions:

I. A consideration of where discharges originate.

II. The characteristics of leucorrhœal discharges.

III. The bacteriology of leucorrhœa. This embraces:

(1) Notes on the literature; (2) a brief description of the material used and nature of this study; (3) the characteristics of fresh smears and of cultures; (4) organisms of chief interest in the cases studied.

IV. Discussion and conclusions.

I—WHERE DO DISCHARGES ORIGINATE?

It is essential to locate the focus of chronic infection with which the leucorrhœa is associated. Most physicians believe we have here to do with an infection of the uterus; hence the usual diagnosis of "endometritis" and the frequent use of the curette in the hope of effecting a cure through removal of the infected endometrium.

To determine whether uterine infection actually exists in leucorrhœal cases, cultures

[1] Read before the Chicago Gynecological Society, December 19, 1913. See discussion on p. 393.

were made from the uterus obtained at operation in several instances, as well as from scrapings from a dozen patients with leucorrhœa. Exclusive of two cases of pyometra, caused respectively by a fibroid polyp and by carcinomatous obstruction of the cervix, in no instance was a leucorrhœa-like discharge obtained from the uterus. Fresh preparations, as well as cultures, failed to reveal the presence of bacteria.

In over 20 patients the cervix was exposed to view and observed for evidence of leucorrhœal discharge, in many the cervix was dilated to assure free drainage during the period of observation, but in none was there evidence of anything more than a mucous discharge from the uterus.

These results, namely, the absence of bacteria in uterine scrapings from leucorrhœal cases, the negative results of cultures from the endometrium, and the failure of persistent attempts to discover a leucorrhœal discharge from the uterus, indicate that purulent discharges are formed in the lower genital tract and rarely consist of bacteria-laden material from the uterine cavity. Mucus, on the other hand, arises from the region of the cervix, especially when it is hypertrophied, everted, or eroded.

II—CHARACTERISTICS OF LEUCORRHŒAL DISCHARGES

The flow is either ropy and mucoid (from the cervix) or of a purulent nature. An admixture of mucoid and purulent material is common. A purulent discharge may be thick and creamy or watery in character. Without assignable cause, a creamy discharge may become watery, or the reverse may be true; with decrease in the consistency there is, as a rule, a corresponding increase in amount. In some instances the quantity of flow is surprisingly great. Such patients are not only forced to make constant use of napkins, but find it necessary to change during the day to avoid soiling their linen.

Döderlein considers a weakly acid or alkaline reaction characteristic of leucorrhœa. I have most often encountered a frankly acid, much less frequently a neutral or slightly alkaline, reaction.

III—BACTERIOLOGY OF LEUCORRHŒA

1. *Contributions to the literature.* The bacteriology of leucorrhœa has received but scant attention. Those studies which have touched on this question have been chiefly concerned with the part played by the vaginal flora in the production of puerperal infection.

In 1892 Döderlein[1] described his vaginal bacillus, the only organism he considers a normal inhabitant of the vaginal canal. This he found to be a non-motile, non-pathogenic, anaërobic, facultative aërobic bacillus, which forms drop-like colonies on glucose-agar. These bacilli of Döderlein really represent a class of similar large gram-positive bacilli, rather than one distinct kind of organism.

Menge and Krönig[2] made an interesting study of the bacteriology of the female genitalia. They did not, however, give special consideration to the bacteriology of leucorrhœa. The majority of bacteria in vaginal secretions they found to be anaërobes, some of which grow on acid media as facultative aërobes. Examination of aspirated material from the cervix and uterine cavity led to the conclusion that bacteria do not live in the normal uterine cavity, and the same holds true in most instances of chronic endometritis.

Wegelius[3] studied the bacteriology of post-partum discharges and classified the organisms found. Obligate aërobes, such as the pseudo-diphtheria bacillus, were present in the vulva, but rarely in the vagina. The coli group was represented in 40 per cent of cases, but it also was almost invariably limited to the vulva.

Heurlin[4] also carefully classified the bacteria found by him in febrile puerperal cases.

2. *Material and scope of study.* Seventy-five patients have been studied; of these 35 had profuse leucorrhœa. All were requested to re-

[1] Döderlein. "Das Scheidensekret und seine Bedeutung für das Puerperalfieber." Leipzig, 1892.

[2] Menge und Krönig. "Bakteriologie des weiblichen Genitalkanales." Leipzig, 1897.

[3] Wegelius. Bakteriologische Untersuchungen des weiblichen Genitalsekrete während der Entbindung, etc. Arch. f. Gynäk., 1909, lxxxviii, 249.

[4] Heurlin. "Bakteriologische Untersuchungen des Keimgehaltes im Genitalkanale der fieberaden Wöchnerinnen mit Berücksichtigung der Gesamtmorbidität im Laufe eines Jahres." Helsingfors, 1910.

turn for frequent examination, and to avoid douches and other sources of local contamination for some days preceding the cultures.

Material for culture was obtained from various parts of the vagina, notably from the vicinity of the cervix, a sterile vaginal speculum and platinum loop being employed in obtaining the discharge. Fresh preparations were also stained for study.

The discharges were cultivated on blood-agar and ascites-blood-agar, as well as on other media, under both aërobic and anaërobic conditions. Isolation of the various anaërobic strains was found to be impossible when only one series of dilutions was employed. The growth, therefore, on those tubes which showed most luxuriant development was reinoculated in varying dilutions upon fresh sets of media. In this way some organisms were isolated in the first set of cultures, while others were obtained in subsequent dilutions in subculture. It has been necessary to repeatedly obtain fresh material for cultures from almost every patient in order to isolate the various organisms present.

3. *Characteristics of fresh smears and of cultures.* The uncontaminated vaginal secretion contains a preponderance of large, gram-positive "vaginal bacilli" of Döderlein (Figs. 1 and 2). The usual case, however, yields a varying number of contaminating organisms. Mucoid secretion, notably in the absence of local inflammation, presents a picture which tends to agree with the normal.

In purulent discharges we find the greatest variations in flora and encounter much difficulty in classifying the bacteria present. In fresh preparations (Fig. 3) gram-negative bacilli tend to predominate. Gram-positive cocci are regularly present; they occur most often in pairs, and may vary considerably in size. Gram-negative diplococci, likewise varied in size, are less common and are less numerous when present.

A determination of those forms which are noxious as contrasted with those of minor importance requires a study and classification of the chief types of bacteria found in leucorrhœal discharges. Such a classification of bacteria common to leucorrhœa is not available and is unquestionably needed.

Anaërobic blood-agar slants show an elevated, roughly beaded, fairly well confined, but rich growth. Control aërobic slant cultures commonly develop poorly in comparison. Aërobic blood-agar plate cultures tend to yield a very poor growth.

From the characteristics of organisms as they appear in fresh preparations, also from the relatively rich growth in anaërobic cultures, as compared with control aërobic cultures, it is evident that the greater number of bacteria in leucorrhœal discharges are anaërobic in nature. It does not necessarily follow that fewer aërobic strains are obtained, for these are easier of cultivation. Many anaërobes, on the contrary, do not thrive on artificial media, and others which grow well in mixed culture cannot be isolated.

It is noteworthy that the cultures made from the vulvar region, in contrast with higher vaginal cultures, contain more aërobes, notably B. coli, staphylococci, and pseudo-diphtheria bacilli. Consequently, high vaginal cultures from patients who are subjected to frequent douching show contamination with similar bacteria, with profuse growth on aërobic media.

In order to observe the virulence of leucorrhœal organisms, animals were injected subcutaneously, intravenously, and intraperitoneally with the vaginal washings from four most pronounced cases. Noteworthy evidences of toxicity were not found. Several rabbits and guinea pigs injected with fresh cultures from similar material were likewise unaffected.

4. *Organisms of chief interest in cases studied.* It must be remembered that during the period of twenty months covered by this work the time-consuming character of the task has allowed a study of only 75 cases, 35 of which had well-marked leucorrhœa. Subsequent findings will enlarge the list of organisms and may be expected to somewhat alter the views concerning the significance of certain bacteria.

BACILLUS 1. Anaërobic cocco-bacillus (Fig. 4). Fairly plump bacilli, typically 2 to 3 microns in length. Extreme variations in length are common. Usually single, they also frequently are found in long chains in which successively occur coccus-

shapes, bacillus forms, and long thread-like varieties. Attempts to secure individual organisms were made by Dr. V. H. Moon, according to Barber's method, but were unsuccessful because of peculiar conditions of surface tension when in suspension. The bacillus is destained by Gram's method, but stains readily with the usual aniline dyes. These bacilli are often present in cases with profuse creamy discharge. Growth is obtained only under anaërobic conditions. Best development occurs on blood-agar and ascites-blood-agar, on which the colonies are translucent and beaded. A poor growth is obtained on ascites-agar; on other media cultures remain undeveloped. Subcutaneous and intraperitoneal injections into rabbits show no evidences of pathogenicity.

BACILLUS 2. Anaërobic bacillus funduliformis (Figs. 5 and 6). These bacilli represent a group allied to Bacillus 1. Extremely pleomorphous, they are most often oval or elongated in shape, with faintly colored bodies and deeply staining ends. Gram's stain is not retained. Nodular, twisted, and globular forms are frequent. A single culture may yield organisms of only one shape, i.e., barrel-shaped bacilli with deeply stained ends, from a subculture of which is obtained an endless variety of forms. Anaërobic conditions are necessary for growth. Best development is obtained on blood-agar and ascites-blood-agar, on which the colonies are large, round, and opaque. On serum-agar, moderate growth occurs. Some strains develop well on alkaline-agar. On other media growth is limited. Gas is seldom produced. Those strains injected into animals were non-virulent.

BACILLUS 3. Anaërobic curved bacillus (Figs. 7 and 8). In a recent description[1] the distinctive features of this organism have been given in detail. Gram-negative, motile, flagellated, crescentically curved, and quite uniform in size, it is easily identified. The bacillus is centrally plump, with tapering or rounded ends, and is from 3 to 5 microns in length. Flagella are present. They are subject to much variation in number, in arrangement, and in point of attachment. In hanging-drop preparations, peculiar rapid, corkscrew motion is observed. Cultures grow only anaërobically. On blood-agar a dustlike coat, composed of minute translucent colonies occurs; on ascites-agar, alkaline-agar and glucose-agar, a slow growth is obtained. Cultures on plain agar, broth, litmus-milk, and potato fail to develop. In cases of profuse leucorrhœa, these bacilli are sometimes in excess of all other bacteria. Following abortion they occur in large numbers. Agglutination tests with the patient's serum were made in one case and proved negative. Pure cultures injected into rabbits are without effect.

BACILLUS 4. A pleomorphous anaërobic bacillus (Fig. 9). A straight or slightly curved bacillus, fairly thick, irregular in outline, and varied in length from 3 to 6 microns. Often single, it also occurs in pairs, sometimes end-to-end, but more commonly placed at an angle. Knobbed and root-shaped forms are frequent. The bacillus stains well but slowly with the usual aniline dyes. Gram's stain is not retained. Best growth is obtained anaërobically. In aërobic cultures there is a very sluggish, poor development, characterized by the appearance of curved, blunted, and knotted forms. On anaërobic blood-agar isolated colonies are translucent and at times plate-shaped, with spreading borders. Thickly growing colonies are similar in appearance to those of non-hæmolyzing streptococci. Organisms from blood-agar condensation fluid are non-motile. A poor growth is obtained on litmus-lactose-agar and on ascites-agar a translucent growth appears. On other media cultures do not develop. This organism is present not infrequently, but is ordinarily difficult to isolate and grow in pure culture.

BACILLUS 5. Anaërobic, short, usually paired bacillus (Fig. 10). This bacillus is one of a group of often-present, similar organisms, of which Bacillus 6 is another example. Organisms identical with or closely allied to these two bacilli are found in almost all cases of leucorrhœa. There is at times some difficulty in distinguishing them from diplococci. Typical forms of Bacillus 5 occur both singly and in pairs. Globular end enlargements, sometimes double and giving rise to ant-like shapes, are frequent. Most stains are taken readily. Gram's stain is retained either very poorly or not at all. Forty-eight hour anaërobic blood-agar cultures contain translucent, round, slightly elevated, non-hæmolyzing colonies. On ascites-agar the growth is similar. A poor development occurs on 0.1 per cent alkaline-agar and growth on 1 per cent acid-agar is rarely obtainable. Only one strain produced an acid reaction in litmus-milk. Broth remains sterile. No gas formation occurs in glucose-agar. The organisms of this group are strict anaërobes.

BACILLUS 6. Anaërobic, small, gram-negative bacilli (Fig. 11), frequently present but repeatedly lost during isolation. Satisfactory sets of cultures were not obtainable. Upon anaërobic blood-agar occurs a delicate, dust-like, translucent growth. Cultures on other media do not develop. Bacilli of this type (see Bacillus 5), small, Gram-negative, mostly paired, two or three microns in length, are frequently found in large numbers in fresh smears and in original mixed cultures. Because of the minuteness of colonies, delicacy of growth, and poorer development when isolated, a differential study of these forms is still incomplete.

BACILLUS 7. Anaërobic bacillus bifidus (Fig. 12). Peculiar branched forms characterize this bacillus. "Y" and angular types are frequent. Deeply staining nodular end enlargements are common. There is a considerable variation both in length and in breadth. The smaller organisms stain lightly, are thin and often slightly curved. Growth does not occur aërobically. On ascites-agar there is an excellent translucent granular development. On

[1] J. Infect. Dis., 1913 xii, 165.

blood-agar similar growth occurs. Nodular forms are frequent on slightly acid-agar and still more numerous on alkaline-agar. Acid is not produced. Gas formation does not occur in glucose-containing media. Bacillus bifidus has been found very few times in this series.

BACILLUS 8. Pseudodiphtheria bacilli (Fig. 13). Especially the large beaded types of pseudodiphtheria bacilli are found. Evidence indicates that when these bacilli are present in the upper part of the vagina it is chiefly in patients who douche frequently, or who have extreme grades of laceration or relaxation of the vulvar region. Their usual habitat is in the region of the vulva. When forced up through mechanical means or when relaxation favors entrance, they are to be found in high vaginal cultures. The relationship of these bacilli to leucorrhœa requires further study.

BACILLUS 9. Bacillus coli. Bacilli of the colon group are present less commonly than is popularly supposed. About the vulva they are frequent. In the upper vagina they are numerous in those patients who make free use of douches. The type most frequently isolated acidifies but does not coagulate milk. In morphology, motility in hanging-drop, and reaction on various media, there are no other noteworthy variations.

OTHER BACILLI. Bacilli of the mycoides and subtilis groups are isolated from patients who have persistently and frequently made use of douches. In smears they are most commonly present in only small numbers, and in plate cultures show but few colonies. Yet in some instances plate cultures are predominated by their rapid growth. Those whose hygienic surroundings are such that sterilization of douche solutions and general opportunities for cleanliness are unsatisfactory are the chief ones who harbor these germs.

Bacillus proteus, a black-pigment-producing organism (found elsewhere), influenza-like bacilli, a small aërobic bacillus, and some other unclassified forms have been encountered also.

COCCUS 1. Anaërobic streptococcus (Fig. 14). In fresh vaginal smears these cocci are practically always in the form of diplococci. On artificial media they form very long chains composed of oval or lancet-shaped cocci in diplo-arrangement. The cocci of different strains are subject to much variation in length and may assume extremely long bacillus-like shapes. Good stains are obtained with the usual aniline dyes. Gram's stain is retained.

Growth occurs only in anaërobic cultures. Best results are obtained on blood-agar media, on which the growth is characteristic of streptococci in general. Hæmolysis does not occur. When cultures are opened, a disagreeable but not particularly foul odor is noted. A fair growth is obtained on ascites-agar. Some strains show a poor development on alkaline-agar and on slightly acid-agar. On glucose-agar growth is poor or wanting. Gas is rarely produced. Litmus milk is not acidified. Broth cultures remain clear and without precipitate. Cultures on blood-agar which was made from a patient's blood showed good growth, but microscopically were found diplococci or cocci only in short chains, whereas control blood-agar cultures contained chains of enormous length. Opsonic and agglutination tests give no indication of immunity. A study of the relationship of anaërobic to aërobic streptococci through determination of the point of opsonic extinction reveals that standard antistreptococcic serum evidently has very little, if any, power of sensitizing anaërobic streptococci.

To ascertain the virulence of various strains, several guinea pigs and rabbits were injected, both subcutaneously and intravenously, with large doses of organisms. There was no evidence in any case of more than temporary distress.

COCCUS 2. Anaërobic staphylococcus (Fig. 15). This minute coccus may be either in small clumps or isolated. It has been obtained only twice in pure culture. Several strains thought to be anaërobic staphylococci have finally grown aërobically. On blood-agar, a poor growth develops. Gram's stain is not retained.

COCCUS 3. Hæmolyzing aërobic streptococcus. In smears of fresh material, these cocci, like the anaërobic streptococci, exist most often as diplococci. In aërobic cultures the organism promptly grows out into long chains. The proportionate number of hæmolyzing streptococci in the vagina is seldom great, but their ease of cultivation often yields a surprising number of colonies on artificial media. The chief features of growth agree closely with those common to streptococcus pyogenes. The scattered arrangement and small proportionate number of these cocci in smears of fresh material lend weight to the belief that they play an insignificant rôle in the production of leucorrhœa.

COCCUS 4. Non-hæmolyzing aërobic streptococcus. Non-hæmolyzing vaginal streptococci, like the other varieties of streptococci, when observed in fresh discharges are rarely found in chains. On artificial media they form chains, the individuals of which commonly have a diplo-arrangement. Some strains consist of very large cocci, 2 microns or more in length and 1½ microns in breadth. The larger types are often in pairs, fours, or short chains, intermingled with which are chains of greater length.

COCCUS 5. Aërobic staphylococcus. Contrary to the general impression, aërobic staphylococci are not numerous in the upper vagina in unmanipulated cases of leucorrhœa. As they are common in the vulvar region, the oft-repeated and careless use of douches greatly increases their frequency. A few colonies are often present, but they are rarely in numbers which signify that the rôle played by them is more than a minor one.

COCCUS 6. Gonococcus. In smears of leucorrhœal pus the gonococcus resists positive identification. It can be differentiated from other forms only if found in considerable numbers and in typical arrangement. From its favorite locations it is,

Fig. 1. Fig. 2. Fig. 3.
Fig. 4. Fig. 5. Fig. 6.

Fig. 1. Typical smear from uncontaminated vagina containing pure growth of Döderlein bacilli. Gram stain. x 1200. Fig. 2. Smear from an uncontaminated vagina showing variation in size of Döderlein bacilli. x 1200. Fig. 3. Bacillus 2. Showing pleomorphism of bacillus funduliformis in pure culture. Carbo-gentian-violet. x 1200. Fig. 4. Bacillus 1. Pure culture anaërobic cocco bacillus. Transition from coccus to long bacillus forms is well shown. Carbo-gentian-violet. x 1200. Fig. 5. Bacillus 2. Anaërobic bacillus funduliformis in pure culture. Carbo-gentian-violet. x 1200. Fig. 6. Bacillus 2. Showing pleomorphism of bacillus funduliformis in pure culture. Most often oval or elongated in shape. Carbo-gentian-violet. x 1200.

however, obtained frequently enough to reveal its enormous importance as the primary cause of subsequently developing leucorrhœa.

It is planned to consider thoroughly the gonococcus-like flora of the lower genital tract. The classification of Bumm,[1] which is probably the best available, leaves a gap in our knowledge of how to satisfactorily differentiate gram-negative diplococci.

IV. DISCUSSION

Certain conditions predispose to leucorrhœal discharges. Important among these are lacerations and displacements, changes in the cervix which cause increased mucous secretion, infections complicating pregnancy, and gonorrhœa.

Although we are mindful of these predisposing factors, our interest centers at present in the various bacteria. *Especially do we wish to know whether bacteria are the cause of leucorrhœa or merely play an unimportant and non-essential rôle.*

Fresh preparations from the uncontaminated vaginal canal show almost exclusively Döderlein's large, gram-positive vaginal bacilli. Many clinically normal cases, e.g., healthy married women, also reveal chiefly bacilli of this type.

The more patients deviate from the absolute normal, with only Döderlein bacilli, i.e., the greater the tendency to discharge formation and the more purulent its nature, the more nearly do the bacteriologic findings resemble in character the picture presented by pathological cases.

[1] Bumm. "Der Mikro-organismus d. gonorrh. Schleimhauterkrankungen." Wiesbaden, Monograph, 1885.

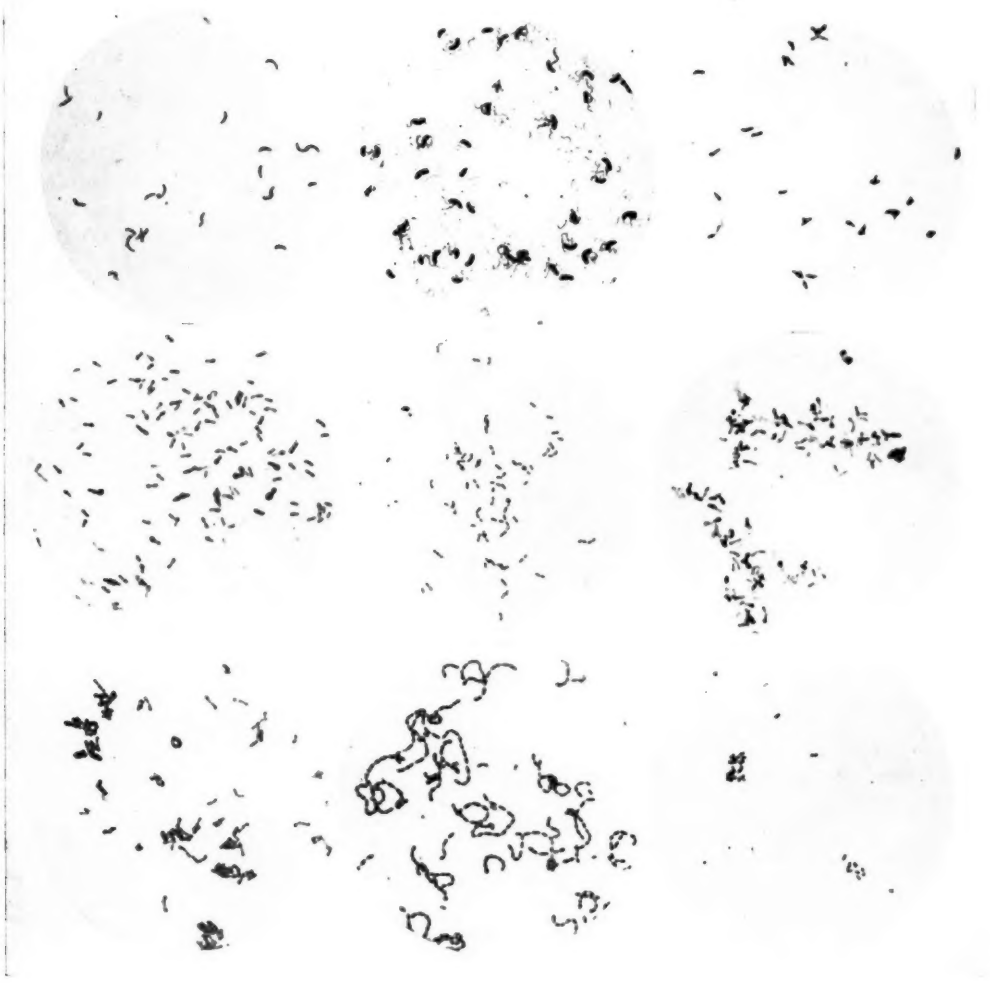

Fig. 7. Fig. 8. Fig. 9.
Fig. 10. Fig. 11. Fig. 12.
Fig. 13. Fig. 14. Fig. 15.

Fig. 7. Bacillus 3. Motile curved anaërobic bacillus. Carbo-gentian-violet. x 1200. Fig. 8. Bacillus 3 (same as preceding). Stained by Zettnow's silver nitrate method to show flagella. x 1000. Fig. 9. Bacillus 4. Anaërobic knobbed and root-shaped forms are prominent here. Carbo-gentian-violet. x 1200. Fig. 10. Bacillus 5. Anaërobic, usually paired. This is one of a group of very similar organisms. Carbo-gentian-violet. x 1200. Fig. 11. Bacillus 6. Anaërobic, small, gram-negative, frequently present but repeatedly lost during isolation. Fig. 12. Bacillus 7. Anaërobic bacillus bifidus. Pure culture. "y" and angular forms are characteristic. Carbo-gentian-violet. x 1200. Fig. 13. Bacillus 8. Pseudodiphtheria bacilli of type common in vulvar region. Gram. x 1200. Fig. 14. Coccus 2. Anaërobic streptococcus. Note diplo-arrangement and large forms. x 1200. Fig. 15. Coccus 2. Anaërobic staphylococcus. Carbo-gentian-violet. x 1200.

Characteristic of smears and cultures from leucorrhœal discharges is the preponderance of anaërobic organisms. Certain types of anaërobic bacilli are predominant. In the cases studied, types represented by Bacilli 6, 5, 2, 1 and 3 have been most frequent. Gram-positive diplococci are always present. Often they are in considerable numbers, but not in groups or chains, and never in excess of bacilli. These facts bespeak a somewhat passive part in leucorrhœa production. *Streptococci are almost never found in fresh preparations, but develop from diplococci on artificial media.* This fact has heretofore apparently been overlooked. Diplococci develop in culture into long-chained, anaërobic streptococci in probably 30 per cent of the cases. Aërobic streptococci are similarly frequent in culture.

Evidence indicates that the anaërobic flora, notably its bacilli, is of paramount importance. An increase in the relative number of aërobes is roughly proportional to the amount of contamination through douches and other external influences. Staphylococci are often found, but they are notable chiefly for their small number. If we exclude those cases in which inflammation is acute, it is doubtful whether bacilli of the colon group actively participate in the production of leucorrhœa.

The rôle of the gonococcus deserves careful consideration. Gonorrhœal infection is the exciting cause of leucorrhœa in the vast majority of women who have never been pregnant. After creating conditions favorable for the development of other organisms, which are accompanied by profuse purulent discharge in an astonishingly large percentage of cases, the gonococcus so completely disappears that it is not demonstrable through any means at our command. This suggests that a chief part played by the gonococcus in chronic leucorrhœa consists in preparing the soil for the leucorrhœa-producing anaërobic organisms.

A final factor of importance in determining the rôle of bacteria in leucorrhœa is shown by the results of treatment. Through bacterial or vaccine therapy alone, as will be reported later, some cases with constant chronic discharge have been markedly affected, both systemically and locally.

These views of leucorrhœa may be summarized as follows:

1. The uterine cavity tends to remain free from bacteria in cases of leucorrhœal infection, but mucous secretion from the cervix may promote the development of purulent discharges.

2. The usual seat of formation of purulent discharges is the lower genital tract.

3. In unmarried women gonorrhœal infection precedes the development of chronic leucorrhœa in the majority of instances. A chief part played by the gonococcus consists in preparing the soil for other organisms.

4. The great contingent of leucorrhœal bacteria consists of anaërobes, of which gram-negative bacilli form a large proportion. It is highly probably that these bacteria play an active part in the production and maintenance of leucorrhœa. Common aërobic organisms, such as B. coli and staphylococci, seem to be of minor importance.

For material furnished and keen interest manifested in this work, I am indebted to Dr. Thomas J. Watkins.

ABSCESS OF THE TESTICLE[1]

By J. DELLINGER BARNEY, M. D., Boston
Genito-Urinary Surgeon to Out-Patients, Massachusetts General Hospital; Assistant in Genito-Urinary Surgery, Harvard Medical School

As an occasional complication in various diseases, such as typhoid fever, glanders, syphilis, tonsillitis, smallpox and mumps, or as a sequel to some septic process elsewhere in the body, acute orchitis, with or without abscess formation, has been recognized from early times. But as a primary disease, without a demonstrable focus from which it might arise, abscess of the testicle is of great rarity. It is this type of orchitis which we propose to discuss. We wish further to make it clear that we are dealing here only with abscess of the testicle, and not of the epididymis.

Although, so far as we are aware, the records of the Massachusetts General Hospital contain no undoubted example of this type of orchitis except the one to be reported, the writer has been fortunate enough to see two others in his own practice. Also, in a somewhat scanty literature on the subject, we have met with only two or three similar cases.

Case 1. A. P., 62 years old, married, builder. Admitted to the genito-urinary service at the Massachusetts General Hospital on December 8, 1912.

Family history and past history negative except as given below. Alcohol to excess as a young man. None for many years. Strenuously denies venereal disease.

When a boy he had a swelling of the left side of the scrotum, not very painful or tender, and of a few days' duration. Another similar attack fifteen months ago, lasting two or three days. No known cause. These attacks were not associated with urethral discharge or urinary symptoms.

October 12, 1912, the patient caught a severe cold. He developed much frequency of urination—every two or three hours by day, every hour by night. Considerable dysuria and tenesmus, but no difficulty of urination or retention. Says the urine was cloudy. After straining at the end of micturition, patient noticed a discharge from the meatus. None between times. Urinary symptoms subsided in about two weeks.

Coincident with the disappearance of the urinary symptoms, which was about three weeks ago, patient noted a swelling of the left scrotum, and this has steadily increased in size and tenderness. Very little pain till recently. Now the pain is heavy, dull, and dragging. Frequency of urination is five or six times by day, three or four times by night. Weight two months ago, 212 pounds; now 195 pounds. No headache or vomiting.

Other than the condition of the left scrotum, physical examination, including prostate and vesicles, showed absolutely nothing abnormal, the only points worth noting being the presence of an extensive pyorrhœa alveolaris and a considerable redness of the throat. The temperature at time of entrance was 98.8° F. Systolic blood pressure was 165 mm. of mercury. The Wassermann reaction and the gonococcus fixation-test were negative. The urine was clear and sparkling, contained no shreds or albumin, and was sterile to culture. Guinea pigs inoculated with it were reported later as negative for tuberculosis.

The penis and right side of the scrotum were normal. The left scrotum presented as a large, rounded tumor, about four inches in diameter, the swelling extending well up into the inguinal canal. Except on the anterior surface the skin was much thickened and brawny. Anteriorly, the tumor was fluctuant, with red, shiny, adherent skin. The tumor was smooth, elastic, moderately tender. Testis and epididymis could not be distinguished. The whole spermatic cord was much thickened, the vas itself not being identified. Dr. Hugh Cabot, who saw the case with me, made a diagnosis of epididymitis with abscess formation.

Immediate operation was advised and performed by the writer. The fluctuant area of the tumor was incised, with the escape of about four ounces of thick, yellow, odorless pus, mixed with necrotic tissue. This pus showed in pure culture the bacillus mucosus capsulatus and the streptococcus. Exploration with the finger showed that this pus came, not from the tunica vaginalis, which had not been opened, but from the surrounding tissues, which were sloughing and necrotic. The greatly thickened tunica was then opened, with the escape of two or three ounces of thick, yellow pus, mixed with necrotic tissue in which were seminiferous tubules. This pus contained the bacillus mucosus capsulatus in pure culture. Attempts to separate tunica from testis revealed dense adhesions between them. The testicle now presented in the incision and was found to contain an abscess cavity the size of an English walnut, from which still more pus and necrotic testicular tissue could be expressed. The epididymis was not seen, but was felt posteriorly, thickened and indurated. The whole spermatic cord was much thickened. This was tied off in sections and divided near the external inguinal ring,

[1] Read before the American Association of Genito-Urinary Surgeons, Washington, D. C., May 6 and 7, 1913.

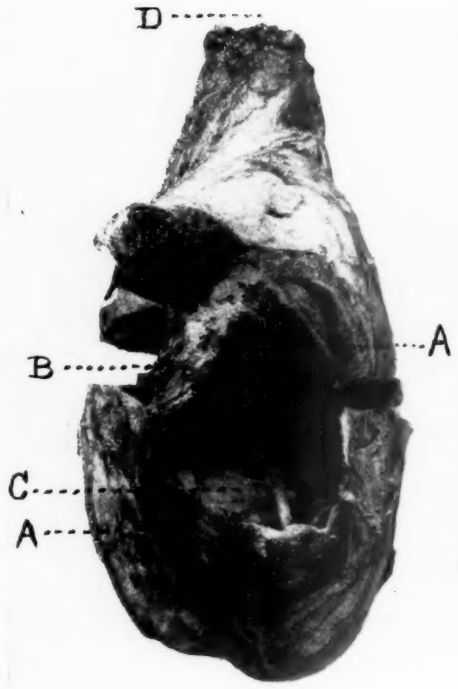

Fig. 1. Anterior view.

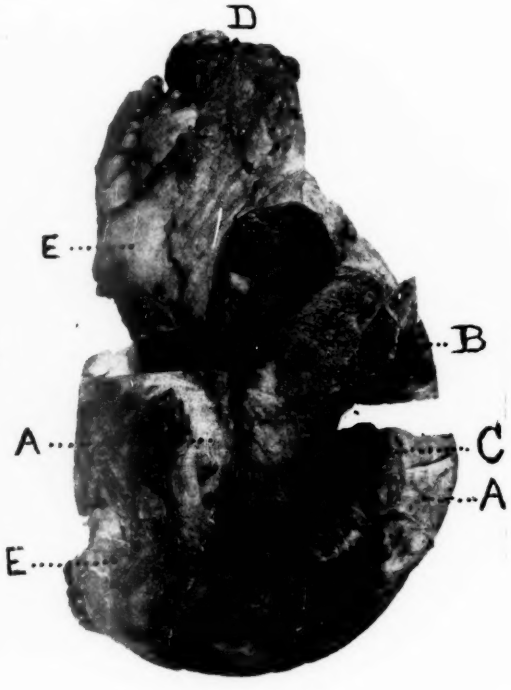

Fig. 2. Lateral view.

Section through the wall of an abscess of the testicle. A, thickened tunica; B, remains of wall of testicle; C, abscess cavity in testicle; D, spermatic cord; E, epididymis. Photographs by L. S. Brown.

thus removing *en masse* the testicle, epididymis, and tunica vaginalis (Figs. 1 and 2). In the cut-section the vas appeared to be normal. The inner aspect of the scrotal wall, very necrotic, was then thoroughly curetted, and the cavity swabbed with tincture of iodine.

Convalescence was uneventful, and the patient left the hospital ten days later.

He came to the out-patient department several times a week for dressings. The wound was entirely healed January 17, 1913. On January 24th he returned with a profuse urethral discharge of about 24 hours' duration. There had been no coitus since October. Urination was four or five times day and night, and there was considerable dysuria. The urine was cloudy throughout and contained a few shreds. Smears of the urethral discharge showed much pus and many large gram-positive intracellular cocci. No gram-negative organisms were seen. A culture of this pus showed a profuse growth of gram-positive bacilli and cocci. No gonococci were found. Four days later the urethral discharge and the symptoms had subsided and the urine was perfectly clear and sparkling. It is possible that the organisms found in the abscess and in the subsequent urethral discharge were identical, but unfortunately no steps were taken to compare them.

Sections of the testicle at the points shown in the photographs (Figs. 1 and 2) were examined by Dr. S. B. Wolbach, assistant professor of bacteriology at the Harvard Medical School. We wish here to express our gratitude for his courtesy. His report is as follows:

"Section through the wall of an abscess of the testicle including testicular tissue and tunica albuginea (Fig. 3). The border

lining the abscess cavity in the testicle contains a few small masses of necrotic material, and in a few places, springing from the interstitial tissue, are small areas of granulation tissue. The tubules in the abscess wall are flattened and distorted. The germinal epithelium shows various stages of atrophy to complete disappearance. The cells of the tubules are represented by thick convoluted bands of hyaline fibrous tissue. The interstitial tissue throughout the wall of the abscess shows connective-tissue increase and the formation of new capillaries. The tubules contain an occasional migrating polymorphonuclear leucocyte. The fibrosed interstitial tissue is everywhere infiltrated with polymorphonuclear leucocytes, lymphoid and plasma cells. The external border of the tunica is very much injected; in places there are small hæmorrhages. It is infiltrated with polymorphonuclear leucocytes, lymphoid and plasma cells. At one end of the section, involving the tunica and the testicular tissue, is an abscess cavity lined with granulation tissue and necrotic material. The necrosis has extended irregularly into the substance of the testicle, following the interstitial tissue. This abscess cavity is apparently at the reflection of the tunica vaginalis upon the testicle. There are smaller abscess cavities in the greatly thickened and fibrosed tunica vaginalis.

"There is nothing distinctive in the pathological process represented by this section. The changes are such as might be found in the tissues surrounding an abscess due to any of the pyogenic organisms. The process has been extending by way of the interstitial tissue. The changes in the tubules are largely due to pressure and subsequent atrophy, except where they are totally necrotic through involvement in the abscess cavity."

The two following cases were seen by the writer in his own practice.

CASE 2. H. K. H., 30 years old, single. Referred by Dr. A. J. Halpin of Lowell, Massachusetts, February 13, 1912, for chronic prostatitis.

The patient had had gonorrhœa about a year previously. Six months later the left epididymis became involved. Since this he had had prostatic massage, irrigations, and sounds regularly every

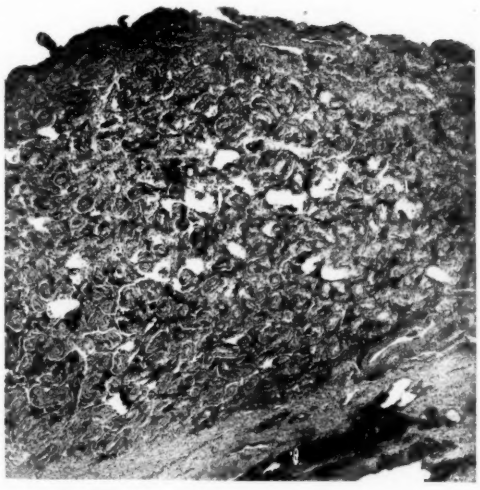

Fig. 3. Microphotograph (13 diameters) of section of abscess wall. Upper edge of section shows abscess wall; lower edge shows tunica. Photograph by L. S. Brown.

week. The urine was clear, with a few shreds; there was no urethral discharge, but there was a little pus in the prostatic secretion. The left epididymis was slightly thickened. After one or two visits the patient disappeared. Two weeks later I was called to see him. On the day after his last visit the left side of the scrotum became tender, painful, and swollen. The condition rapidly grew much worse. There was marked constitutional disturbance, evidently much fever, and great pain. There had been no urethral discharge or urinary symptoms.

When seen by me the patient looked very sick and had evidently lost much weight. The left side of the scrotum was much enlarged, red, indurated, and brawny. Anteriorly the tumor was fluctuant. The vas was moderately thickened. Nothing abnormal was made out in the right side of the scrotum or in the prostate or vesicles. No discharge could be milked from the urethra. Urine was not seen.

The fluctuant area was incised, with the escape of about one ounce of thick yellow pus, containing the colon bacillus in pure culture. Testicular tissue, necrotic and sloughing, appeared in the wound. There were many strong adhesions between the layers of the tunica vaginalis. On separating these the epididymis was found to be essentially normal in size and consistency. The whole lower half of the testicle was involved in an abscess, leaving a cavity around which was a dense, tough, yellowish wall. The upper half of the testis appeared to be normal in size and consistency, and, together with the epididymis, was left behind in the hope of saving it. The necrotic tissues were carefully curetted and the wound drained.

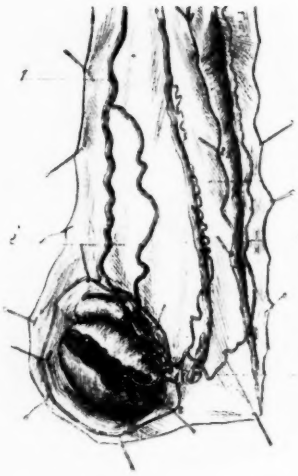

Fig. 4. Type 1. 1, spermatic artery; 2, epididymal branch of the spermatic; 3, deferential artery; 4, funicular artery; 5, epididymo-funiculo-deferential anastomosis in form of T. Photographs of Figs. 4, 5 and 6 by L. S. Brown after Picqué and Worms.

Fig. 5. Type 2. 1, spermatic artery (main trunk); 2, internal spermatic artery; 3, external spermatic artery; 4, epididymal branch; 5, deferential artery; 6, funicular artery; 7, spermato-funiculo-deferential anastomosis in form of T.

Fig. 6. Type 3. 1, spermatic artery; 2, epididymal branch of spermatic; 3, deferential artery; 4, funicular artery; 5, anastomosis between epididymal branch and deferential artery; 6, anastomosis between a testicular branch of spermatic and funicular artery.

Convalescence was uneventful, except that during it the upper half of the testicle sloughed out, leaving behind an epididymis which, up to date, seems perfectly normal.

CASE 3. G. B., 35 years old, single, lawyer. Referred to the writer on December 31, 1910, by Dr. John W. Dewis of Boston.

Gonorrhœa several times, with bilateral epididymitis four years previously. About four weeks ago the right side of the scrotum became swollen and painful. Patient was confined to his bed for several days on account of pain and tenderness. A few days ago an abscess formed in the front of the scrotum, causing much pain. There has been no discharge from the urethra and no abnormality of micturition.

The patient looked sick and haggard. The right side of the scrotum was found to be much enlarged, very œdematous, indurated, and reddened. In front, near the raphé, there was a soft, fluctuant area. The scrotal contents could not be made out. The left testis and epididymis were normal.

Orchidectomy was performed by the writer. The whole spermatic cord was much thickened and matted together, but the vas itself was not enlarged. Incision of the fluctuant area in the scrotum allowed the escape of much thick pus, mixed with necrotic testicular tissue. The tunica was much thickened and adherent to the testicle anteriorly. The latter was involved in an abscess which invaded chiefly its upper half. The epididymis did not seem to be inflamed. Unfortunately, no cultures were taken.

That the testicle, even in the presence of an actively suppurating epididymis, is extremely resistant to bacterial invasion we are all aware. Its power to recover from severe infection, as, for example, tuberculosis, after removal of the primary focus in the epididymis has been shown by the writer in his studies of epididymal tuberculosis. It would seem, therefore, that Nature had planned well to preserve to the last an organ which is of prime importance, not only for her welfare but also for that of its owner.

The defense of this vital organ is twofold, consisting on the one hand of its dense and intimately applied tunica albuginea, on the other of its rich and elaborate blood supply; and finally, we must regard the rich lymphatic network with which it is surrrounded and permeated (Testut and others) as being a protective factor of no little value. Also we regard it as possible that the little under-

stood but none the less recognized internal secretion of the testicle may contribute more or less to its comparative immunity. The value of the albuginea as a protective shield was recognized and described years ago by Gendrin, whose opinion was also shared by Curling. The latter says:

"When the contiguous organ or adjacent part is of a different structure from that of the cellular tissue, the extension of the inflammation inward is checked. Thus in the case of the inflamed tunica vaginalis the cellular tissue readily transmits the morbid action to the epididymis, but the tunica albuginea arrests its progress to the body of the testicle."

The elaborate blood supply already mentioned is to be regarded as a two-edged sword. Not only can it maintain such a high state of nutrition in the testicle that incoming bacteria are readily discouraged, but obviously it also serves as the high road along which these organisms can travel. This rich vascularity of the organ, a kindly provision of Nature not only for the salvation of the reckless surgeon, but also for the testicle itself, has been demonstrated by Picqué and Worms, who have perfected and confirmed the work of many earlier investigators in a large series of careful dissections of injected human specimens. They have shown constant but slightly variable anastomoses between the spermatic, the deferential, and the funicular arteries (the latter running in the walls of the tunica vaginalis). These variations fall roughly into three groups (Figs. 4, 5 and 6). In each, however, it is clear that blood is conveyed to the testicle by the three different arteries already mentioned, any one or two of which may be, and often are, destroyed without harm to the organ.

If now we are to regard the rich blood supply of the testicle not only as a means of defense but also as the conveyer of infectious organisms, we may well ask, Why is not the one function of the blood stream nullified by the other? The question is partially answered by the statement of Belfield that the testicle, like the kidney, is an excretory organ. He has recently said:

"While the kidney is provided with a new and private sewer, the ureter, the testis continues to use the frog's old urinary duct, now called epididymis and vas deferens. This excretory function of the testicle and its duct illumines both its intimate alliance with the kidney and its frequent infection from the blood. . . . The recognition of the testicle as an excretory organ illumines the frequent invasion of its tubules by mumps, typhoid and colon bacilli, spirochæta pallida, and other blood infection."

For our purposes we must go farther, and attribute to the testicle not only an excretory but also a selective function. In this way only can we explain its freedom from invasion by the gonococcus and, to a certain extent, the tubercle bacillus. For these two organisms at least, and especially the first, the testicular soil is inimical. On the other hand the testes seem, on occasion, to offer favorable conditions for the growth of the organisms of typhoid fever, mumps, glanders, and syphilis. These organisms rarely if ever attack the epididymis, and then only late in the disease. Here again is evidence of a selective function.

The pyogenic organisms such as the colon bacillus, the bacillus mucosus capsulatus, and the staphylococcus aureus find conditions favorable for their growth in testis as well as in epididymis. In this group we can also place the tubercle bacillus, for, as we are all aware, while it attacks the epididymis primarily, it may later invade the testicle, flourish there in a half-hearted manner, and disappear after the removal of the primary focus.

It is our conviction that organisms of various types may and do circulate in the blood stream at various times and under certain conditions. To the fact that they find lodgment in certain organs and tissues when circumstances are favorable is due the occupancy of most of the beds in our hospitals.

It is clear that these organisms find their way into the testis and epididymis as freely and as frequently as into other organs, perhaps more so, owing to the fact that their main blood supply, the spermatic arteries,

take origin from the aorta, which might reasonably be called the distributing center. But we have seen (Figs. 4, 5, and 6) that the circulation of the testicle and epididymis is not only very rich, but also is so arranged that organisms passing through any one of the three main arteries have free access to both organs, more especially the testicle. This being the case, we must look to the selective action of each organ, already discussed, to explain the invasion of testicle by one organism, of epididymis by another, and of either or both organs by a third. Furthermore, we must ascribe infection of the epididymis, more frequent by far than that of the testicle, to a less active resistance, this being due perhaps to the difference in the blood supply of the two organs which we have seen exists, and also to the comparative poverty of the epididymis in its lymphatic circulation.

What evidence have we that the infection of the testicle in the three cases reported occurred, not by way of the vas deferens, not through the lymphatics, but by way of the blood stream?

In the first place Esmonet, in 1902, showed that the testicle could be infected much more easily and frequently by injection of organisms (tubercle bacilli) into the general circulation through the aorta than through the vas deferens, even though a condition of stasis was produced by ligature of that structure. The more recent work of Walker has confirmed this view. Speaking of his experimental production of tuberculosis of the testicle in guinea pigs, he says:

"In those cases in which the animals had received injections into the aorta and were killed within a short time afterward I found in one gland several small capillaries containing tubercle bacilli, and in another I observed very young tubercles close to the blood-vessels. It is presumable from this that the organisms penetrate the walls and form a tubercle in the immediately surrounding tissues."

What applies to the tubercle bacillus may apply as well to other organisms. But it must not be forgotten that in clinical material, owing to the length of time which generally elapses from onset of disease to time of operation, the pathologist is obliged to read the story backward, a feat which he is either unwilling or unable to perform.

Secondly, it is now universally acknowledged that renal tuberculosis occurs, not by ascending infection through the ureter from the bladder, but by a hæmatogenous or lymphatic route. In other words, infectious processes tend to follow the natural route of the secretions or excretions of the organs involved. Thus it is also acknowledged by most that in genital tuberculosis the epididymis is primarily attacked, prostatic involvement being secondary. Thus the tubercle bacillus follows the current in the vas deferens from epididymis to prostate. Even in the frequent examples of involvement of the second epididymis shortly after the involvement of the first side there is ample experimental and clinical evidence to show that this too is not a deferential, but a hæmatogenous or, in certain cases, a lymphatic transmission of bacilli.

Thirdly, in many infections of the testicle by the typhoid bacillus, as well as by other organisms, repeated examination of the urine microscopically and bacteriologically has revealed no bacteria. The infection is clearly hæmatogenous, although in a few cases note has been made of the involvement of the whole spermatic cord or of the vas, indicating possibly a migration of organisms through the lymphatics.

And so it must be regarded in our first case, if not in the others as well. All the diagnostic means at our disposal failed to reveal a focus of infection in the body, not even in the genital or urinary tract, although it seems probable that the patient had had an epididymitis and possibly a prostatitis, perhaps of gonorrhœal origin. The patient had a severe pyorrhœa alveolaris and a reddened pharynx. Possibly a culture from these two points would have thrown light on the matter. The infection of the testicle in the second case with the colon bacillus is equally obscure and purely a matter of speculation. But in both it seems clear that the infection was hæmatogenous, although we cannot exclude a lymphatic origin.

This view is strengthened in the first case at least by the report of the pathologist, who finds the process to have extended by way of the interstitial tissue, a fact which suggests a blood-borne infection. The work of Walker seems to bear out this belief.

Reduced to its lowest terms, this discussion summarizes as follows:

1. The testicle is protected from infection by its tunica albuginea on the one hand and by its rich blood and lymph supply on the other.

2. Arguing from an embryologic viewpoint, the testicle, like the kidney, may be regarded as an excretory organ.

3. As blood-borne organisms reach epididymis and testicle with equal freedom and frequency, it would appear that the latter has a selective function, rejecting certain organisms and harboring others.

4. Most of the testicular infections are hæmatogenous. A few probably are lymphatic in origin.

5. Infection of the testicle resulting in abscess and without epididymal involvement is exceedingly rare.

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ELEPHANTIASIS CONGENITALIS LYMPHANGIECTATICA

WITH THE REPORT OF CASE FROM THE SERVICE OF DR. BESLEY AND A PATHOLOGICAL REPORT BY HARRY JACKSON, M. D., OF THE NORTHWESTERN UNIVERSITY MEDICAL SCHOOL, DEPARTMENT OF PATHOLOGY

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ALTHOUGH in the title of this article I follow the classification of Kaufman, it is not my intention to insist upon any essential difference between this condition, which I have named as a variety of elephantiasis, and the lymphangiomata. If anything, its frequent situation upon the entire lower extremity, its lobulation, with cutaneous thickenings and subcutaneous fibrosis, and the general pathological character indicative of vascular stasis and dilatation, with subsequent fibrosis rather than of new growth, are the considerations in favor of this nomenclature. Nevertheless, the distinction between the congenital types of elephantiasis and lymphangiomata (which are usually congenital neoplasms) is little more than one of terminology. Hereafter they will be spoken of rather indiscriminately. Both present the same hyperplastic elements, not only the lymphatic vessels, but also the fatty and fibrous tissues, and the smooth musculature of the walls of the larger lymphatics participating in these growths (Ribbert). A variable amount of lymphatic fluid, often very abundant, occupies the dilated and tortuous lymph channels, and in addition there may be considerable tissue œdema.

The congenital origin bespeaks a disturbance in embryonic development. Thus these conditions may often be associated with other anomalies, such as myeloceles, encephaloceles.

Their size may be complete at birth, as in our case given in illustration, small tumefactions may undergo unlimited subsequent enlargement, or neoplasms may develop late from congenital beginnings.

Lymphangiomas may be simple, cavernous or cystic, but most forms actually encountered are mixed or transitional in character.

Simple lymphangiomas are proliferations of lymphatic vessels and connective tissues, occurring usually upon the face and neck as congenital, flat or somewhat nodular thickenings of the skin and subcutaneous tissues, which are but slightly circumscribed. They are related to pigmented nævi, lentigines, freckles, and flesh warts; but these, because of their excessive hyperplasia of endothelial cells, are better classified with the endotheliomata (Ziegler).

Cystic lymphangiomata present uni- or multilocular cysts, minute in size to that of a child's head. These are lined with endothelium and filled with serous fluid. Sites of predilection are the neck, posterior to the sterno-cleido-mastoid, about the angle of the jaw and in the supraclavicular fossa; less frequently, the cheeks, axilla, groin, extremities, the anterior surface of the sacrum and in the root of the mesentery. They are definitely encapsulated and thus the most favorable type for surgical measures.

It is, however, the cavernous lymphangiomas, or those forms chiefly cavernous, that principally concern us here, as they are practically identical with congenital, lymphangiectatic elephantiasis. We give in illustration a case report of an instance of the latter. A study of the microphotographs illustrative of this case gives a good example of the dilated lymph spaces, which are characteristic of this type of angioma.

Lymphangioma cavernosum is the most frequent form of the diffuse, non-encapsulated lymphangiomas. They appear in the cheeks (macromelia), the lips (macrocheilia), the tongue (macroglossia), the concha, eyelids and mucous membrane of lips and palate — also as lobulated growths of considerable size upon the face, the neck, and the lower extremity (as in our case), and it is to these forms that the term "elephantiasis congenitalis lymphangiectatica" has been applied.

Fig. 1.

Fig. 2.

Fig. 3.

Possibly their appearance and location (when on the leg) have been suggestive of this name. It would be of no practical value to enter into theories of etiology, such as intrauterine pressure and subsequent stasis being causal rather than neoplastic formation; and as before stated, the pathological differences are not inessentials.

The example given presented mainly the picture of cavernous lymphangioma, and if portions vary, it is to be remembered that most of these are mixed in form.

These tumefactions occur in the skin, subcutaneous, and sometimes in the intermuscular tissues. Their appearance, as indicated above, is variable, from the flat, smooth, loose swellings in the cheek to the lobulated forms. Their boundaries are ill-defined. The lymph spaces communicate with the legitimate lymphatic channels, so that prolonged pressure reduces the size of the tumor, and the same is gradually regained later upon its cessation. The overlying skin is little, if at all, discolored, and cannot be raised from the tumor. Pachydermia is more common in the lobulated forms; consistency is soft, with an indistinct sense of fluctuation.

Slow growth is usual. Rapid increase and decrease in size is common in all forms of lymphangiomas, sometimes due to the occurrence of infection. Acute inflammation may result in subsequent cicatrization and shrinkage, but may lead to dangerous complications, such as extension along lymphatics or sloughing and exhausting lymph fistulæ. Regular growth is, however, the rule; skin and muscles may be infiltrated, nerves and blood vessels pushed aside, and even bone eroded.

Treatment is most satisfactory in the cystic forms which are encapsulated, and may be completely enucleated by blunt dissection, removing as much skin as may be required. Complete removal is not possible in the simple or cavernous forms. Partial removal of deep wedges is disappointing in result, and there is danger of inflammation and lymph fistula. The repeated injection of irritants may cause some diminution in size. Cauterization should be discarded; also ligation of the blood supply of the part, as the latter does no good and may result in gangrene.

The following case presented some unique points of interest, and is reported for statistical purposes:

Case No. 33,729, Ronald R., was admitted to my service at Wesley Hospital, September, 1911. The patient, a two year old boy, is normal in every way, except for the condition of the right lower extremity. The father stated that labor had been normal and that the enlargement of the limb was noted at birth. As nearly as could be ascertained, the rate of growth of the enlargement was proportionate to the growth

Fig. 5.
Fig. 6.

Fig. 4.

Fig. 7.
Fig. 8.

Fig. 4. High power magnification obj. 2/6 showing dilated lymph-channel surrounded by loose connective-tissue stroma in which there is round-cell and plasma-cell infiltration. Fig. 5. Lymphangiectases in the deeper, loose connective tissue. Fig. 6. A portion of tissue from the deep layers showing loose meshwork of connective tissue and dilated lymph-vessels, obj. 2/3. Fig. 7. Low power magnification obj. 2/3. Dense connective tissue undergoing hyaline degeneration. Marked lymph-angiectases. Fig. 8. Low power magnification obj. 2/3. A portion of the tissue near the surface showing fibroma-like character.

of the rest of the body and limb. Examination revealed a large lobulated mass on the right thigh and posterior aspect of leg. It is firm, inelastic and attached to the skin, the whole mass moving freely on the deep tissues. Figs. 1, 2 and 3 give the idea of its shape, size and position. The limbs were of equal length, and, except for a little awkwardness, the child walks without difficulty. There was nothing in the family history that had any bearing on the pathogenesis. A skiagraph showed the bones of the leg to be unaffected.

The patient was anæsthetized and a free incision made over the posterior aspect of the tumor mass. It was found firmly fixed to the skin throughout its entire extent, but separated rather easily from the deep fascia. It was possible to remove a large part of the mass and cover in the defect with the remaining skin. There was a free escape of a large amount of serum from the wound for a number of days, but it healed without any destructive suppuration. The patient returned home and died of a pneumonia about six months later.

The following is the pathological report, made by Dr. Harry Jackson, of the Pathological Department of Northwestern University Medical School:

PATHOLOGICAL REPORT OF A CASE OF ELEPHANTIASIS CONGENITALIS LYMPHANGIECTATICA FOR DR. BESLEY.

According to Kaufman, elephantiasis may be classified etiologically as elephantiasis congenitalis and elephantiasis acquisita.

Elephantiasis congenitalis may also be hereditary and it usually appears as tumor-

like swellings of the skin which are partly fibromas with lymphangiectases, and partly neurofibromas. Elephantiasis acquisita may be of the tropical type, which is endemic in tropical countries, and is due to the filaria sanguinis hominis. These organisms block up the lymph channels and appear in the blood-stream during sleep.

Elephantiasis nostra is the acquired type usually found with us, and occurs after chronic or recurring inflammations of the skin. It has been found after erysipelas, lymphangitis, eczema, tuberculosis and syphilis. With the removal of the lymph glands, for instance of the groin, elephantiasis has been produced in the penis and scrotum.

Location. Elephantiasis is most commonly seen in the lower extremities and in the male and female genitalia. It may occur in the lips and tongue, as macrocheilia and macroglossia. It affects the epidermis, cutis and subcutis, with an increase of the connective tissue and a widening of the lymph channels, while the muscle, fat and nerves are destroyed.

Varieties. According to consistency, we have:

Elephantiasis dura, a form in which the connective tissue is very dense, and gives to the tissues a hard consistency.

Elephantiasis mollis, which has an œdematous connective tissue which is grayish white in color.

A study of the surface allows of the following classification:

Elephantiasis glabra, in which the skin is smooth.

Elephantiasis verrucosa, in which the skin is rough and warty.

Elephantiasis tuberosa. Here the skin is in thick plaques presenting an appearance resembling ichthyosis.

Elephantiasis nigra, with pigmented skin.

Elephantiasis lymphangiectatica, a variety in which the lymphatic spaces are dilated or varicose, and from which one can squeeze a milky fluid.

Description of a portion of the excised tissue. Grossly, the skin appears thickened and reticulated. From the meshwork a thin, milky fluid can be expressed. There is considerable adipose tissue present. Near the skin surface, the tissue is dense and the lymphatic spaces are small. Deeper, the tissue is loose and soft in consistency, the lymphatic spaces larger, and the fluid content greater in amount.

Microscopically, the superficial portion of the section which, on gross examination, was so dense is seen to be made up of connective-tissue bundles undergoing hyaline degeneration. The lymph sinuses, lined by a single layer of endothelial cells, are dilated and irregular in shape and fairly numerous. Some of them contain a granular debris, lymphocytes and some red blood cells. In the connective tissue are accumulations of small round-cells. The blood vessels show passive hyperæmia.

In the deeper portion of the section, the connective tissue is arranged in a loose meshwork throughout which there is considerable adipose tissue. The lymph channels are widely dilated. Some are compressed and appear long and narrow, while others are irregular and tortuous and show dilatations. A few large round-cells are scattered throughout this tissue, and there is much œdema. In this tissue, deeply placed, are also seen isolated bundles of muscle fibers.

FREE TRANSPLANTATION OF FASCIA[1]

By EDMOND M. VON EBERTS, M. D., AND W. H P HILL, M. D , Montreal

THE feasibility of transplanting tendon was demonstrated in 1881 by Gluck, who transferred a segment of tendon from one fowl to another without loss of function. In 1887 Peyrot transplanted a piece of tendon 4 cm. in length from a dog to a tendon defect in the finger; the transplant healed in position and function was partially restored. About the same time Monod obtained a perfect functional result by transplanting a rabbit tendon to a defect in the flexor longus pollicis of a human patient. Mainzer in 1902 reported two cases in which union occurred in homotransplants used in the bridging of tendon defects. Following the publication of von Hacker's work upon the autoplastic repair of tendons, however, attention was directly chiefly to his method. The experimental work of Martin Kirschner gave renewed impetus to the whole subject of free tendon and fascia transplantation, and latterly not only has a considerable amount of confirmatory experimental work been done but the practical application has also been put to the test.

Our work was carried out in the Department of Experimental Medicine at McGill University during the early months of 1912. It consisted in the transplantation of a segment of fascia lata from one dog to an artificially prepared defect in either the tendo Achillis, the dura mater, or the peritoneum of the same dog. Twenty-six operations in all were done, and they are described here in three groups.

GROUP I

In the first group of nine experiments a segment of fascia lata was transferred to an artificial defect in the tendo Achillis. The technique was as follows: The tendo Achillis in one leg was exposed by a lateral incision, a retention suture of chromicized catgut inserted, and the segment of tendon included in the suture excised. An incision was then made over the iliotibial band and a piece of fascia removed, 1 cm. longer than the tendon defect and wide enough to form a cylinder of the same circumference as the excised tendon. This flap was next rapidly transferred and sutured with fine chromicized gut around the tendon stumps, the retention suture being included within the cylinder. Finally, the tendon sheath was sutured with fine catgut. The muscular surface of the fascia was turned outward as being that surface less likely to form adhesions with the tendon sheath. This method of procedure was followed in seven cases. In the other two, instead of the ends of the stumps being included within the cylinder of fascia, end-to-end suture of the graft to the tendon stumps was performed.

Results. In six of the seven cases done by the first method lengthening was entirely prevented and function was regained wholly or in part, according to the lapse of time between the operation and the destruction of the animal. In the seventh case, as the suture between the fascial graft and the lower stump did not hold, there was slight lengthening but comparatively little loss of function. In the two cases done by the second method the yielding of the sutures led to permanent lengthening of the tendon, and there was, consequently, only partial restoration of function.

Following the grafting of fascia in such a position, there is at first a marked thickening owing to exudation within the tendon sheath and to proliferative changes in the surrounding tissues. This thickening about the graft subsides gradually, and with its subsidence there is a concomitant improvement in function, until finally normal movements are restored. The dog from which specimen No. 7 (Fig. 1-b) was taken was killed 33 days after operation, at which time, although there was still a slight limp, the animal was able to stand on its hind legs and jump about without evident pain or discomfort. There was no deformity. In animal No. 24 (Fig. 2), killed six and two-thirds months after operation, there was complete restoration of function.

Specimens were taken from all the animals in this group except one, and each specimen

[1] Read before the Montreal Medico-Chirurgical Society, December 6, 1912.

(c) (b) (a)

Fig. 1. a, Tendon defect allowed to heal without grafting; shows marked lengthening of the tendo achillis; b, grafted tendon 33 days after operation; shows marked thickening of the tendon; moderate grade of muscular atrophy. Tendon normal in length; c, normal tendon.

Fig. 2. Grafted left and normal right tendon from dog killed six and three-fourths months after operation showing normal length of grafted tendon, slight thickening at the site of the graft, and slight muscular atrophy. In this case there was complete restoration of function.

shows that the graft retained its normal gross and microscopical appearance.

The comparison of a tendon in which the defect has not been repaired (Fig. 1-a) with one in which it has been repaired by a graft (Fig. 1-b) proves at once the value of the graft. Undue lengthening and loss of function in the tendon have been prevented. A further comparison of the grafted tendon (Fig. 1-b) with the normal tendon (Fig. 1-c) shows that there is no lengthening whatever.

Microscopical preparations from these grafts show unaltered fascial elements, that is, fascial fibers or bundles of fibers with unaltered staining reaction of the component cells. In grafts removed a few days after operation there is seen, in varying degrees, an inflammatory reaction, chiefly evident in the space between the tendon sheath and the transplant, and characterized by the exudation of lymph and the proliferation of connective-tissue cells derived from the inner surface of the tendon sheath. There is a similar though less marked inflammatory

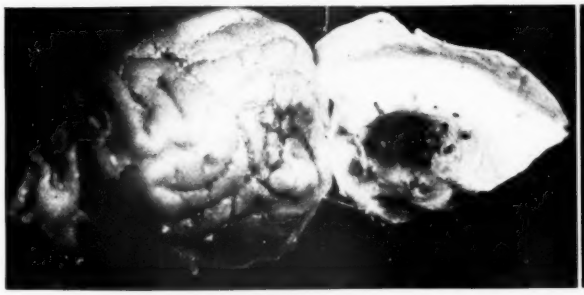

Fig. 3

Fig. 3. Specimen showing dural graft. A few adhesions were present at the center of the graft, beneath which at the time of operation, owing to hæmorrhage, a cortical vessel had to be ligated. There are, however, no adhesions

Fig. 4

along the line of union of the graft with the dura mater.

Fig. 4. Fascial graft of the meninges viewed from within the skull. Complete absence of adhesions between pia arachnoid and graft.

reaction in the tendon sheath itself and in the tissues immediately surrounding it, the whole representing the early inflammatory changes which are responsible for the marked thickening that shortly follows operation and, in the final stages, for the permanent thickening that is usually present in a greater or less degree. There are no signs of vascular invasion of the graft nor of multiplication of the fascia cells. On the other hand there is no necrosis. The grafts are apparently kept alive purely by lymph seepage.

GROUP II

In the second group of three experiments, segments of fascia lata were transplanted to artificial defects in the dura mater and sutured into place with silk thread. One of the animals died of œdema of the lungs at the conclusion of the operation. Photographs of specimens from the other two animals are here shown. In one (Fig. 3) there are a few adhesions at the center of the graft, beneath which, at the time of operation, a cortical vessel had to be ligated owing to hæmorrhage. There are, however, no adhesions along the line of union of the graft with the dura mater. In the second specimen (Fig. 4) there is perfect union, and adhesions have not formed between the pia arachnoid and the graft. In these cases the muscular surface of the fascia was turned toward the brain. The outer surface of the transplant became adherent to the overlying temporal muscle. Convalescence was uninterrupted. As it was thought more desirable to show the grafts in position, a microscopical examination of the transplants was not made.

GROUP III

In the third group of 14 experiments, segments of fascia were transplanted to artificially prepared peritoneal defects. The muscular surface of the grafts was turned toward the peritoneal cavity. Although there was no injury to the surface of the grafts and no unnecessary exposure of the tissues to the air, adhesions of varying extent formed in all of these cases between the inner surface of the graft and the great omentum. Preventive measures, such as smearing the inner surface of the graft and the suture line with vaseline, flooding the field of operation with saline, packing off the intestinal coils presenting with vaselined silk tampons, and everting the peritoneum and margins of the graft by means of Mayo's stitch, all proved without avail. It may be said, however, that in the dog a suture of the peritoneum in the neighborhood of the median line can rarely if ever be performed without the occurrence of such adhesions. In all of these cases, with the exception of one in which failure of the intratracheal insufflation apparatus caused a break in the technique, the wounds healed by first intention. Microscopical slides prepared from the grafts implanted in the parietal peritoneum show the unaltered state of the fascial elements and the inflammatory changes associated with the adhesion formation between the graft and the omentum.

The success of experimental work upon the free transplantation of fascia and tendon has led to its practical application in the repair of tendinous and muscular defects and in the closure of hernial orifices where other methods have failed or are likely to fail. It is now generally believed that the lack of success met with formerly in tendon grafting was due to faulty surgical technique and not to the presence of a detached tissue element, that is, one without direct vascular connection. The fact that such grafting is now successfully performed speaks volumes for the technique of the modern experimental laboratory.

In the human subject, material for transplantation is usually obtained from the fascia lata. After the field to which the graft is to be transferred has been prepared, a curved incision with convexity forward is made on the postero-external aspect of the lower third of the thigh and the necessary amount of fascia stripped from the underlying muscles. This is then transferred quickly and sutured into position. The raising of the fascial flap should be effected without scoring or other injury to its inner or muscular surface. The muscular surface of the transplant should be turned outward, since under normal conditions this surface glides over the muscles and shows less tendency to form adhesions than does the outer surface — a factor of especial

importance in the repair of tendons. After the main operation is completed, the wound in the thigh is closed with skin sutures. No attempt is made to obliterate the fascial defect, partly because in most cases it is impossible to do so, and also because experience has shown that the presence of such a defect is in no way detrimental to the function of the underlying muscles.

Fascial grafts heal without reaction and without appreciable diminution in size, the two requisites being, of course, the avoidance of unnecessary mechanical injury to the tissues and the observance of a strictly aseptic technique. Failure owing to infection is naturally more likely to occur in non-aseptic cases, but even in such cases, in which defects in the intestinal canal, the urinary passages, and the trachea, have been repaired, and in one case of ectopia vesicæ in which a large area of the transplanted fascia necessarily remained exposed, prompt healing has occurred.

Since the publication of his experimental work Kirschner has employed extensive fascial transplants in man in 40 cases and has observed its use by others in 10 cases. In every case the transplanted fascia has met the demands made upon it. For the fascial repair of tendon defects Kirschner recommends, in a recent publication, the technique employed by us in our experimental work, that is, the inclusion of a considerable portion of both tendon stumps within the ends of the cylinder of fascia; and he points out that by this means tension may be avoided and the danger of suture failure very greatly lessened.

Since the appearance of Kirschner's work we have had an opportunity of employing a free fascial transplant in the repair of a defect of the abdominal muscles following appendicectomy. The history of the case is as follows.

J. L. L., aged 23 years, was admitted to the Montreal General Hospital on June 22, 1911, on the third day of an attack of acute appendicitis.

Under morphine gr. 1/6 and nitrous oxide-oxygen anæsthesia, the usual incision for appendicectomy was made. The internal abdominal oblique was found to be œdematous. An area of the transversalis fascia and the peritoneum 6 cm. vertically by 3 cm. transversely was entirely necrotic, and immediately beneath these necrotic layers, lying in an abscess cavity, was a perforated gangrenous appendix. The appendix was removed and a drainage tube inserted. The two outer muscular layers were brought together with interrupted catgut sutures, and interrupted silkworm-gut sutures were placed in the skin. On the eleventh day after operation, as there was complete obstruction of the bowel, an incision was made in the median line and a large pelvic abscess was evacuated. A second abscess was evacuated by digital exploration through the original appendicectomy wound. From this time convalescence was uninterrupted.

On February 2, 1912, the patient returned for the removal of the scar and the repair of the original appendicectomy wound. Under morphine gr. 1/4 and nitrous oxide-oxygen anæsthesia the scar tissue was excised, and the edges of the external and internal abdominal oblique muscles in the path of the scar were freshened and retracted, exposing a wide defect in the transversalis fascia. A flap of fascia 4 by 6 cm. in area was then removed from the anterior surface of the right rectus abdominalis muscle and sutured with fine chromicized gut into this defect. The internal and external abdominal oblique muscles were next sutured with interrupted catgut over this fascial flap, the whole forming a firm, resistant covering to the peritoneal and transversalis defect. The wound healed without reaction and the patient has since been free from any sense of weakness in the abdominal parietes.

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A SUMMING UP OF THE GOITER QUESTION[1]

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CONCERNING the development of the thyroid, embryologists have returned to their former belief that the gland is developed from a single instead of three anlage. It originates between the three portions of the developing tongue and early descends to its final resting place upon the trachea. The tubular line of descent is known as the thyroglossal duct and early undergoes obliteration. The remains of this structure often persist at the posterior portion of the tongue the foramen cæcum. Gaskell has shown, however, that in the higher invertebrates the duct persists as such and in great part delivers into the genital tract, the analog of the thyroid thus being evidently a sex gland. Occasionally the gland remains in the tongue as a lingual thyroid; again, portions are separated in descent as aberrant thyroids, or partially attached as accessory thyroids, while the midline cysts are usually due to the persistence of pharyngeal embryonic mucosa carried down in the thyroglossal duct by the descending gland.

The gland, horseshoe in shape and consisting of two lobes connected by an isthmus, rests astride the trachea, to which it is quite firmly attached by its capsule. No other organ in the human body is so well provided with a blood supply. In proportion to its weight it receives 28 times as much blood as the head, and all the blood in the body passes through it, as it does through the brain, once every hour. It has been shown to be five and a half times more vascular than the kidney. While the lymphatics are numerous, those leaving the gland are small as compared with its wonderful blood supply, apparent activity, and production of secretion. It is probable, however, that this secretion is delivered into the veins by short lymph spaces throughout the gland itself. Baumann showed long ago that there was a high iodine content in the human thyroid. There is much less in herbivorous animals. Marine has done much work on the iodine content of the thyroid in warm-blooded animals and fish. Hunt and Smith have carried on biochemic tests for the same substance.

The secretion of the thyroid is thin, watery, and non-stainable, and it is probable that the active cells represented by one-sixth of the gland are sufficient to furnish the necessary amount of secretion for the preservation of good health.

As has been stated, the gland in the higher invertebrates is apparently a sex organ. To some extent this relationship holds through vertebrates, including man. At the period of puberty some increase in the size of the gland is quite common. This is often noted during menstruation, and especially during pregnancy; while at the menopause many of the symptoms are apparently those of alternate hyper- and hypoactivity of the thyroid, as shown by its effect upon the nervous and circulatory systems and nutrition. While it is probably as active in the control of early growth, both mental and physical, as is the thymus, a child born without a thyroid fails to develop mentally or physically; and its loss in the adult usually leads to a peculiar deterioration known as myxœdema.

The variations in the gland without symptoms are so great that it is almost impossible to state what is normal thyroid. Undoubtedly the gland has a considerable storage function, and when this is carried to excess it leads to local areas of stasis due to pressure atrophy of the producing cells. Such glands constitute many of the atoxic (simple) goiters, though here also are included some of the encapsulated adenomata of both adult and fœtal type. Colloid, then, may not be an essential secretion, but a spongy holding material thrown out by the gland in exerting its storage function.

In exophthalmic goiter — so-called hyperthyroidism — there is always a true hypertrophy and hyperplasia, an increase in the cells and activity of the gland. Atoxic (simple) goiter includes about all varieties not inflammatory, exophthalmic or malignant, yet in this group have been included a large

[1] Read before the Clinical Congress of Surgeons of North America, Chicago, November 14, 1913.

number of cases of toxic thyroid due to degeneration of the gland and presenting many of the symptoms of exophthalmic goiter, particularly those of the cardiovascular systems, but always without protruding eyes. These cases, in Europe, are frequently classed as pseudo-exophthalmic goiter.

In simple goiter there is the enlargement of the thyroid, which may follow its normal contour or occur in the isthmus or either lobe and present the colloid type. It may also be an encapsulated adenoma representing a rounded tumor of the whole gland or any portion of it. The sudden appearance of a tumor of the thyroid with symptoms of pressure may come from internal hæmorrhage or from active hyperæmia, while infections with severe, acute symptoms of toxæmia are but rarely seen.

Substernal goiter is noted in about one in forty cases of simple goiter; slight substernal projections occur much more frequently. They are diagnosed by symptoms of respiratory pressure, prominent veins extending from the neck down onto the chest, by percussion, and by the röntgenogram. The very large ones are fortunately of the encapsulated adenoma type, admitting of enucleation.

Simple goiters are subject to changes of the cystic type, especially the encapsulated adenomata, while fibrous and calcareous degenerations are seen, and some cases present all varieties.

Exophthalmic goiter presents a fairly sharp clinical picture. Its onset, as a rule, is relatively acute and the course of the disease fairly definite. Early in the history, the clinical picture is that of a toxin acting directly on the more vital organs, more notably the central nervous and vascular systems. Later it is made more complex by the interaction of those organs whose functions have been directly disturbed by the toxin. The order of onset of the more important symptoms based on the average of our series is as follows: (1) cerebral stimulation, (2) vasomotor disturbances of the skin, (3) tremor, (4) mental irritability, (5) tachycardia, (6) loss of weight, (7) cardiac insufficiency, (8) exophthalmos, (9) diarrhœa, (10) vomiting, (11) mental depression, (12) jaundice, and (13) death. In some cases certain of the symptoms may not be present in the early stages of the disease, which makes the condition difficult to diagnose. There are certain conditions of the nervous system of unknown origin, which much resemble this disease. As a rule, however, these patients have symptoms extending over many months. They have neither exophthalmos nor an increase in the size or density of the gland, and are not benefited by operation on the gland.

In carcinoma and sarcoma of the thyroid the picture is usually one of rapid growth of the gland, which becomes hard, and irregular, often with neighboring glandular involvement. These symptoms may also occur in a simple goiter of long standing, however. Because of lymphatic and venous delivery with the early capillary involvement, early metastases in glands and lungs are common and local recurrence is the rule. In such cases, when the disease is confined within the capsule, treatment requires removal of the entire gland.

Because of their interrelationship in function and location, the parathyroids and the thymus are considered in relation to the diseases and especially to the surgery of the thyroid. The parathyroids are usually four in number, a superior pair and an inferior pair. They are situated on each side and behind the thyroid, but intimately connected with its capsule. Much is attributed to the action of these little bodies in maintaining the equilibrium of the mineral salts of the body, especially of the calcium. Experimental evidence shows that, when removed from animals, a condition of muscular spasm known as tetany develops, following a rapid loss of the mineral salts. The blood supply consists of terminal branches from the vascular anastomosis between the inferior and superior thyroid arteries. Their veins have no valves. Thus they frequently become injured by hæmorrhage during the congestion occurring at birth, to which is attributed infantile tetany and also tetanic attacks of later childhood and even of adult life. Tetany following operation is apparently associated with their removal or an injury to their blood supply,

associated with a great loss of thyroid tissue. In such cases the best treatment is the feeding of fresh beef parathyroids, and, following MacCallum's plan, the restoration of calcium to the body, preferably through the administration of calcium lactate in 5 per cent solution, at repeated intervals. In addition to this, the feeding of thyroid is indicated, and some cases are reported as benefited by the parathyroid serum.

The thymus is believed by some physiologists to be a gland of marked interrelationship with the thyroid in the growth of the body, and in the hyperplasia of the thyroid the thymus is usually found enlarged. While this is true of the majority of cases, it by no means holds good in many of the most serious cases, as shown at autopsy following both medical and surgical deaths of these individuals.

The thyroid consists of a great number of groups of cells which may be found even in the adult in various stages of development, from unarranged embryonic cells, Wolfler's rests, to well-developed follicles lined with epithelium, secreting into a well-marked central cavity. The simplest change is hyperæmia, which may be temporary, occurring through the nervous system or more prolonged through systemic infection. It may be sufficient, however, to produce hæmorrhage within the gland.

Acute inflammation of the thyroid may occur as the result of traumatism or general bacterial disease. Progressive hyperplasia consists in an increase in the number of parenchymatous cells, usually of a hypertrophic type, either in single or multiple layers. This may occur in parts of the gland or throughout all of it. True adenomata of the thyroid can be identified only when encapsulated. Histologically they are either fœtal adenomata, the parenchyma of the true fœtal type, or adult adenomata in which the parenchyma has taken on adult characteristics, i.e., follicles lined with cells of adult type and subject to all the changes which are noted in the thyroid outside of encapsulated tumors, that is, the various degenerations.

Of the retrogressive changes, retention of secretion is the more common, the simpler, and the more nearly normal physiologic state, as the thyroid is not only an actively secreting organ, but normally has a storage function. Colloid appears to be the basis for the preservation of this secretion. When it occurs in excess, the condition is pathologic and leads to degeneration or atrophy of cells.

Atrophy of the thyroid results from overwork, pressure, and lack of nutrition to the gland. Simple goiter may undergo such a degeneration from these causes and in the production of toxic materials so affect the circulatory and nervous systems that the condition resembles the more severe toxic state of exophthalmic goiter, or in fact any chronic toxæmia.

To a variable degree thyroid enlargement may be due to demands made upon its secretion by certain systemic conditions, such as sexual development at puberty, the goiter of adolescence, the enlargement or hyperæmia at menstruation, enlargement in the latter part of pregnancy, the changes at the menopause, and last, but not least, the possible iodine demand occasioned by bacterial infection of various organs.

Accumulated evidence shows that endemic goiter frequently comes from a water-borne irritant. In such cases ensuing chronic intestinal toxæmia may occasion the extra demand on the thyroid. McCarrison in his investigations of the subject in India, has done much to prove this.

The various types of goiter should be treated both medically and surgically. Many goiters of the simple and mild exophthalmic type undoubtedly recur spontaneously, although various forms of medical treatment may hasten the recovery and restoration of the gland to an apparently normal condition in many instances, especially in the early stages of simple goiter.

Simple colloid goiter which has resisted treatment and encapsulated adenomata are in most instances best treated by removal of the diseased portion of the gland with preservation of its better portions. If the diseased part is not removed, such glands will later in life expose the individual to a serious menace, since the degeneration which follows in an average time of about fourteen years may be of such a character as to permanently damage

the heart, kidneys, and liver. During middle life such degeneration frequently follows the ill-advised use of iodine; the severity of the toxic process places these patients on a par with the severe types of exophthalmic goiter. Plummer has shown a great similarity in the damage to the essential organs of the body, such as the heart, kidney, and liver, by various forms of toxæmia. In exophthalmic goiter, however, the essential condition identifying it from all other toxæmias is the parenchymatous increase of the thyroid. Exophthalmos occurs in no other systemic condition. The staring eye (Stellwag) and the widening of the palpebral fissure (Dalrymple) may occur with other toxic myocardial lesions, especially that of advanced Bright's disease. Exophthalmic goiter is essentially a disease of a chronic character, presenting exacerbations and ameliorations of symptoms extending over a period of months or several years. After the first year the gland often undergoes a regression.

While this disease is amenable to surgical treatment by the removal of a large amount of the hypersecreting gland, it is by no means emergent surgery, and all patients, during periods of exacerbation, should be considered as medical cases. Surgery is indicated in the up-wave of improvement. The majority of these patients can withstand thyroidectomy at the time they are seen by the surgeon. Extreme conditions, especially dilatation of the heart, may require medical preparation, and the operative interference following in cases resistant to treatment should be confined to injections of boiling water into the gland after Porter's plan to hasten improvement. In most of the severe cases a ligation is made, first, of the left upper pole only. Should the reaction following this be severe, the ligation of the right upper pole is indicated a week later, and thyroidectomy reserved until four months have elapsed, by which time these patients have made an average gain of 22 pounds, with great general improvement. However, if the reaction following the left ligation is not unduly severe, a partial thyroidectomy may be made at the second operation the week following.

In operating, the best exposure of the thyroid is obtained by a curved transverse incision through skin and platysma, extending between the anterior jugular veins with wide separation of the flaps, midline vertical division of the muscles exposing the thyroid. If division of the muscle be necessary, it should be made at the upper part of the dissection to break the line of scar and preserve muscle-function. In some cases the wound may be closed without drainage, the cavity being filled with salt solution. As a rule, however, patients having tubular drainage for 24 hours are more comfortable. A subcuticular closure of the wound with catgut, approximating first the platysma muscle, secures an almost imperceptible scar.

The anæsthetic of choice in most instances is ether. Complicated cases, however, may be best carried through the operation by the local use of 0.5 per cent novocaine solution with the addition of a little adrenalin. Occasionally the combined use of a local with a general anæsthetic is advisable, the local anæsthetic, relieving the pain, necessitates less of the general anæsthetic to secure sleep.

In severe forms of Graves' disease the use of 1/200 grain of scopolamine with 1/6 grain of morphine one hour previous to operation is often a distinct advantage. Some patients seem to have an idiosyncrasy to the drug, and in such cases the operation must be postponed 24 hours to permit elimination. In all cases in which ether is used as the general anæsthetic, 1/200 of a grain of atropine should be given one-half hour before the operation, to maintain a dry trachea and pharynx during the operative procedure.

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A RUBBER TUBE IN THE RECONSTRUCTION OF AN OBLITERATED BILE-DUCT: AN HEPATICODUODENOSTOMY

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THE use of a rubber tube to assist in the replacement of a common bile-duct occurred in a young woman of 28 years as the result of cicatricial contraction and obliteration of the common duct following infection and sloughing due to the damaging presence of gall-stones.

At the first operation the gall-bladder was found thickened and inflamed like an inflamed and thickened bowel. It was not large but felt almost as solid as a lobe of the liver. It was filled with a septic mucoid material in which there were a number of fair sized stones. The gall-bladder was tortuous, with a sharp bulging letter "S" curve at the base just before its junction with the cystic duct, with two small stones in the lower pocket beyond the reach of the scoop. The gall-bladder was removed, with a portion of the cystic duct, after it had been tied near the common duct with chromic gut. No stones were felt in the common duct, which was traced to the ampulla of Vater, nor in the hepatic ducts. A drainage tube was fastened near the stump with a separate stitch of iodized gut and the abdomen closed in the usual manner.

There was a fair amount of pain the first 48 hours. At the end of this period bile began to flow freely and continued to drain in gradually decreasing amounts until it was about stopped the twenty-sixth day after operation. The wound had healed by first intention up to the drainage opening, but the patient had had more or less nausea and at times periods of vomiting. Her temperature had fluctuated, running to near 103° F. by the third day after the operation, and stayed as high as this for two days more, when it dropped to 101°, and by the fourteenth day to 99°. Meantime the discharge had rapidly assumed the character of the normal bile discharge, with almost no suggestion of pus, and the stools were light brown. The patient vomited on the twenty-second day and did so each day thereafter until the twenty-seventh day, when a large amount of thick gray pus was discharged through the drainage wound, with a temperature running only to 100.4° F. The patient continued to have nausea for some days and occasionally vomited. The stools were of fair color at several days after the operation, but getting lighter and becoming gray by the fourteenth day, after which they varied a little from light brown at the time of the pus discharge to yellow and to gray and back to light brown before she left the hospital. In poor condition at the time of the operation, she was gradually reduced to ninety pounds, though she began to feel better soon afterward. The pus discharge was gradually reduced in amount, and finally became thin and an almost clear fluid (sometimes in large amounts. At the end of the eighth week the dressings were suddenly saturated with bile, with the patient up and about and stools running fairly light. The bile flow was abundant, and gradually lessened during the next three weeks, when the sinus closed and stayed closed.

The patient went to the country and gradually picked up until she considered herself better than she had been for many months, though her strength had not fully returned. About four months after leaving the hospital, a slight jaundice began to show for the first time, and she felt listless and below tone. The jaundice slowly increased over months of time until at about two years from her operation she had the bronzed color of a Mongolian. She suffered from intense and persistent itching, and the stools were of clay color. As this condition had not improved under medical care, a second operation was determined upon to investigate and see if anything could be done to better her condition.

Five months ago this was done. The omentum was found turned upward over the transverse colon, the stomach, and duodenum,

and filling the deep cavity from which the gall-bladder had been excavated. This was loosened, and while the bowels in the general abdominal cavity were found free from adhesions, the tissues in the region of the gall-bladder and bile-ducts were adherent everywhere, and all landmarks were obliterated.

Only those who have been similarly situated can realize what a formidable condition this was to untangle, especially in the absence of the gall-bladder. The under surface of the liver was fastened by a mass of adhesions to the omentum, the duodenum, the stomach, and the gastrohepatic ligament. The foramen of Winslow was obliterated and all tissues were fastened by rather dense adhesions wherever they came in contact with each other. Profuse hæmorrhage welled up from a vein in the region of the gastrohepatic ligament, and it seemed that the portal vein had been opened. With great difficulty this vein was finally traced up to the stomach and was ligated, much to our relief. No common bile-duct was found. A small nipple-like prominence was finally uncovered in the region of the hepatic duct, which looked like a bulging portion of the portal vein. This was investigated most carefully and finally opened; it proved to be the stump of the common hepatic duct. This gave forth a flow of dark bile and mucus, and issued almost at once into the right and the left hepatic ducts. Nothing could be found of the common bile-duct except some indefinite thickening of the fibrous tissue, although the whole region well down behind the duodenum was carefully examined. The hepatic ducts were dilated to a size larger than a lead-pencil. A probe and a small gall-stone scoop dropped easily into both of these ducts from the nipple-like stump which we had opened, but there was no sign of a dimple or an opening into the common duct. This had been obliterated, apparently, as a result of the inflammatory process of two years before. Two stones were recovered from the left hepatic duct, one small, smooth and dark, the other a soft stone mass which could be molded with the fingers.

By this time the patient, who had not been in very good condition before the operation, was showing rather marked symptoms of shock, and it seemed necessary to close the operation as rapidly as possible. The writer decided to substitute a 3/16-inch rubber tube for the common duct. A length of 1¾-inch was taken and passed through a small incision in the convex surface of the duodenum, after the end had been beveled to prevent the swelling of the duodenal mucous membrane from occluding the opening, and after a linen stitch, for security, had been passed through the tube, both ends of which had been passed through the small incision in the duodenum and out through all the coats of the bowel lower down, to be tied later and fasten the tube with its beveled opening toward the bowel lumen. This linen stitch was to serve the purpose, also, of retaining the tube in place until the process of healing was well advanced, and so give the mucous lining of the duodenum and that of the stump of the hepatic duct time to grow toward each other, and so have the process of lining the new tissues which were going to make up the artificial duct well started before the tube could loosen and slip down into the bowel and be passed out of the body.

In order to make something of a papilla to act as a valve and prevent the irritating and infective backflow into the bile-ducts from the duodenum at its periods of increased intra-intestinal pressure during peristalsis, three circular stitches were taken in the duodenum about the rubber tube at different distances, as in the Kader-Senn operation for gastrostomy, making the tube lie in the inverted funnel of the external duodenal wall. The tube was properly turned and the security stitch in its end was now tied.

The opposite end of the tube was inserted into the opening in the stump of the hepatic duct, which was made rather larger than the tube to allow a fairly free drainage of the diseased bile past it and on out of the abdominal drainage wound. The tube fitted into the dilated hepatic duct loosely and would easily permit this drainage. Two mass stitches of celluloid linen were now taken, one on either side of the tube, into the tough scar tissue of the hepatic stump and through the tissues of the duodenum, drawing these

structures firmly into place but leaving a small portion of the circumference open for drainage. A rubber drainage tube was inserted through the abdominal incision down to the region to be drained, but not in contact with the tissues sutured, in order that it might not interfere with the healing in any way.

The patient was in a precarious condition after operation, but finally pulled through a siege of double bronchopneumonia, from which it seemed for a time that we might lose her. Bile flow into the dressings was abundant from the first, and the stools continued of light yellow color for about a week, when they became darker in color. They fluctuated back and forth before they settled down to a normal color, and the amount of bile passed also fluctuated from time to time, being more abundant, as a rule, when the stools were lighter in color. The amount of bile drainage stopped down markedly on the eighth day, and was passed in varying amounts for a week more, when it ceased.

When the tube passed on into the duodenum is not definitely known. All stools were ordered searched, but this was not always done. Our patient was in a low state of vitality, and a sluggish inflammation showed up in the fat layer along on the seventh and eighth days. After this had been healed for some time, a small rounded mass slowly developed deep in the abdomen. This was opened under local anæsthesia, and proved to be an abscess between the omentum and the inner side of the ascending colon, deep in the abdomen. This was of such low virulence that the discharge was practically gone in three days.

The convalescence was slow, but the patient now (five months after the operation) has gained steadily from a weight of 94 pounds to 127 pounds and feels better than she has for three years. She has slowly lost her deep jaundice, until the whites of her eyes are clear; the skin has lost its bronze and the intolerable itching is gone. She is proud of the muscle she has developed in her arms.

It would seem that this method might have some value in some of these difficult cases of reconstruction of the bile ducts. The rubber tube allows the construction of a papilla in the duodenum, which may very well be flattened down and closed by the intra-intestinal pressure during the peristaltic contraction and open again for the passage of bile during the period of relaxation. This would tend to prevent the dilatation of the bile ducts by the back pressure from the duodenum, which has been shown by Coffey [1] and others to take place in experimental work on dogs when a direct anastomosis is made between the open end of a duct and the duodenum. The dilatation in some has been enormous. In one experiment the bile duct was almost as large as the duodenum and almost as thick. If infection and cholangeitis from the backflow of the bowel contents can be prevented in this way, it will be a strong point in favor of the method.

In the next place, even when the duodenum can be brought up to the level of the stump of the common duct, or even of the hepatic duct, the rubber tube simplifies the operation, for the operation of anastomosis by suture alone, with delicate tissues in the stump to work with, at the bottom of the deep and narrow slit between the liver and the surrounding structures, is always a difficult one, if not at times almost impossible. When the distance from the stump of the duct to the duodenum does not allow a safe approximation, the rubber tube allows the surrounding tissues to be drawn about it to form a new tube; or it may be covered with an omental graft, as was suggested by Sullivan after he had used the end of the omentum turned up over the transverse colon for this purpose in his experimental work on dogs; or other tissue transplants might be used, such as peritoneum, superficial fascia or fascia lata.

Dr. George E. Brewer [2] of New York attempted the reconstruction of a bile duct in a patient who had lost most of the common duct from suppuration and gangrene following a removal of the gall-bladder. He followed the suggestion of Sullivan, and after fastening one end of a rubber tube to the interior of the hepatic stump and inserting

[1] Coffey. Ann. Surg., Phila., 1909, p. 1238.
[2] Brewer. Surg., Gynec. & Obst., 1912, xiv, 433.

the other end into the duodenum through a small incision, he wrapped the intervening portion with an omental graft. But he did not construct a papilla nor an oblique passage into the duodenum. This patient died some time later, from what seems to me to have been the result of an ascending infection, and not from occlusion (the reason Brewer gives), for her death came on rather rapidly in an acute attack of distress which followed at some interval two similar attacks from which she had recovered spontaneously.

CONSERVATIVE SURGERY OF THE TESTICLE[1]

By GRANVILLE MacGOWAN, M. D., Los Angeles

IN the quarter of a century or more in which I have been actively engaged in the practice of medicine and surgery, I have witnessed a very great deal of careless and wanton surgical destruction of the essential sexual organs, both of men and women. It is but a few years since it was very dangerous for a woman to complain of any pain in the pelvis or of any semi-hysterical nervous crisis to her family physician or to her surgical consultant. The ovaries were regarded as the prima facie origin of all obscure disturbances of nutrition, intellect, or temperament, and the idea prevailed that by the removal of these organs the re-establishment of physical and mental balance was certain to occur. I have many times stood by the operating table and watched the removal of ovaries that looked to me as normal as it is possible for any organ to be whose periodically recurring functional work monthly contributes to its anatomical deterioration. It seemed to me that such operations, anticipating by years the coming of the menopause, were a social cruelty and unwise surgery.

Fortunately, this method is no longer fashionable, it having almost disappeared from the practice of surgeons of standing; the myriads of little cutters, who imitate like monkeys, now seek to conserve organs which they formerly hastened to annihilate.

The practice of castration of men has never been an extensive one, for the reason that the male almost invariably looks with disfavor upon any operative procedure that robs him of that functional capacity which he values most highly. The consent of women is much more easily obtained to castration than that of men, for obvious reasons. A man knows that if he is deprived of his testicles he will become impotent, and he fears also that his appearance will change in such a manner that his misfortune will be evident to others, but nevertheless, inspired by fear, he will consent to such a mutilation when he believes that the sacrifice will prevent the spread of a dreaded disease or save his life.

So it occurs frequently that testicles are removed when they might very well be saved by the exercise of a patience, skill, surgical ingenuity, and anatomical knowledge that a very large number of persons doing surgery do not possess. Without the testicles, and an unobstructed pathway for the spermatozoa from the testicle to the penis, there is no possibility for a man to become a father. In the absence of the testicle, or in the presence of a distinct degeneration of its glandular tissue, the sexual function, in all cases, becomes weakened, and, in most cases, is entirely lost after a very few years; but it is difficult to say always how much of the secretory structure may be destroyed and yet sexual capacity and potency be preserved.

There are certain diseases of the testicle, as malignant growths, which require the speedy removal of the organ in order to save the life of the individual. These conditions cannot always be recognized by even the most skillful diagnostician until he has explored the organ. But where the patholog-

[1] President's Address, American Urological Association, Boston, April 16, 1913.

ical condition is not clearly defined, and there is a possibility of a mistake in diagnosis by which, in case the organ is not removed, the patient may lose his life, it is best always to sacrifice it, with his consent, and then only if but one of the testicles is involved and the other is healthy.

There are, however, two diseases of frequent occurrence which, with the exception of very rare cases, do not call for castration, and in which it should never be exercised without an effort, or repeated efforts, having been made to save the organ by conservative surgical treatment and by medical measures. I refer to tuberculosis and to syphilis. Where one or both testicles is the seat of pathological change that has not followed a traumatism, in which the testicle, or a portion of it, is indurated and painless, it should always be suspected that such a growth, whether it has been rapid or slow, is luetic; and we are not justified in removing the organ until we have fully tried out all of the modern methods for the treatment of syphilis.

Such growths often occur in young men very suddenly, without any distinct history of syphilitic infection. The world is full of people who have acquired syphilis in an extragenital way and are entirely ignorant of their affliction. They are unable to give any history of a primary lesion. Ignorant, untrained, and unobserving, they may or may not have had distinct skin or mucous membrane lesions, but they cannot tell you—they do not know. It is perfectly possible that a young man may develop gummata in both testicles and in both epididymi without having contracted syphilis at all; he may be the victim of an hereditary lues which has developed very late. It is true that in late hereditary syphilis a careful search will, in most instances, show one or more of its stigmata—there will be, perhaps, faint cicatrices of corneal ulcers long since forgotten, or perhaps never known of by the subject; irregularities in the dental arch; imperfections of the sense of hearing; deformities or deficiencies of the osseous framework dating from early childhood; or definite lesions of the joints pointing to the probability of the existence of hereditary syphilis. If there is a number of children in the family, or if the elders are alive, observing, and truthful, a history of parental syphilis can usually be elicited by the marriage history and confrontation. Yet gummatous lesions may exist in the testicles of boys between 18 and 25 with a very faint or no history of heredity, and they are very difficult to distinguish from malignant tumors.

No testicle should be removed from such a patient until he has been subjected to the modern blood tests for syphilis, to the vigorous use of intramuscular injections of salicylate of mercury or gray oil, and to the intravenous injections of salvarsan or neosalvarsan, together with the administration of ascending doses of iodide of potassium. The treatment should be the same whether a history of syphilis is clear and direct or only surmised or suspected. Whether the disease is acquired or inherited, it is not very likely that gummatous degeneration of the testicle will exist alone; yet it is entirely possible that, at least at the time of the primary observation, such a thing may occur. I am sure that I have seen it. It is very seldom that syphilitic testicles do not clear up under a thorough antisyphilitic medication; yet sometimes they do not, because the blood-vessel supply and lymph-channels are blocked by the pressure of thick-walled hydroceles of the tunica or adhesions. In such a case, recourse must be had to conservative surgical measures. In this connection, I will report a case.

About fifteen years ago, a very successful young New York publisher, 30 years of age, applied to me for the treatment of his lues. He had multiple tertiary lesions. These consisted of serpiginous ulcers upon the back, chest, and both thighs, a scaly palmar syphilide, gummatous nodes upon both tibiæ, the sternum, the soft palate, and in both testicles; associated with this were an intense cachexia, profound anæmia, and a slowly progressing dementia. This man knew the nature of his disease; he had been sent to California to hide from his friends and relatives, and had been referred to me for treatment. The testicular tumor on each side was firmly adherent to the tensely stretched skin, and probably was ten times the size of an ordinary testicle, hard and indurated like ivory; but at the upper portion of each it seemed to me I could detect at times slight fluctuation.

The mental habit of this individual was such that

he paid very little attention to his skin and his bones and to the threatened perforation of his palate; his whole mental concern seemed concentrated upon the probable loss of his testicles, and I could only get him to consent to systematic treatment by continuously keeping before him the fact that his disease would, if not vigorously opposed, in all probability unsex him. He was given daily injections of one-seventh grain of bichloride of mercury deep into the muscular tissues of the back. This old-fashioned treatment, while it is very effectual, is extremely painful at times, so that I had great difficulty in keeping him to it. Iodide of potassium was given in ascending doses until he was eventually taking 40 gm. per day. All of the skin and bone lesions cleared up in a month. The mental symptoms, which were more those of endarteritis than actual luetic degeneration of brain tissue, also rapidly improved, so that his mental powers returned to practically their full vigor; but the syphilitic infiltration of the testicles was not in any way affected by the treatment — neither became softer, and neither became smaller. He was very much depressed by this incident, and one day suggested to me that I explore one of the testicles and find out whether there was any chance of it ever becoming useful. He thought, perhaps, that if the tension were relieved the medical measures might have a better opportunity to become successful.

The normal cellular tissue which one finds between the dartos and the tunica had been changed into a thick, fibrous mass. On the right side the tunica vaginalis, at its lower and middle portion, had adhered to the testicle and had become obliterated entirely; at the upper part it had formed a dense sac, enough of the sera being left to make a hydrocele partially enveloping the cord. It contained about 30 ccm. of fluid, and was under very high pressure, being kept tense by the thick sac on the outside and by the gummæ in the epididymis and the testicle on the inside. This was laid open freely and the remains of the tunica dissected away, and the hard fibrous adhesions between the sac and the testicle below were broken up by blunt dissection. A much smaller hydrocele was found in a similar position in the left testicle. More of the tunica was obliterated on this side, and the adhesions were closer between the fibrocellular envelope and the testicle; these also were broken up and dissected out. The testicle on the left side was smaller and not so tense. Softening had not taken place in the gummata in either testicle. The skin and the remains of the sac on both sides were stitched together and the cavities packed with iodoform gauze. We then continued the treatments with the sublimate and iodide. Within a few hours after the removal of the tension the condition of the testicle commenced to improve, and inside of two weeks the gummata had completely disappeared and the testicles were restored to the consistency of normal glands.

This gentleman remained under my care for a year, and at the end of that period he seemed to be entirely well, judged by the standards which we then had for ascertaining the success of our treatment. I instructed him to continue the use of mercury by the mouth, under the guidance of a New York physician, for four years. In the interval I frequently heard from him, and during that period of time he had no recurrence of any symptoms which his physician could detect as syphilitic. At the end of five years he married, and two years later I received a photograph of himself and his wife and a very healthy looking boy baby.

The remarkable thing about this case is the fact that the treatment made no impression whatever upon the gummatous degeneration of the testicles until the tension was relieved by the opening of the deep-lying hydrocele and the loosening up of the adhesions between the testicles and the obliterated portion of the tunica. Since that time I have repeated this experience twice, though in neither instance was the individual so profoundly poisoned constitutionally as in the case reported; but in both of them there was no response to the mercury or iodide until the tension was relieved. This is what I term conservative surgery applied to syphilitic testicles. If that could be obtained before the advent of the powerful remedy of Ehrlich, how much more readily could it be accomplished now.

TUBERCULOUS TESTICLES

All over the world, every day, surgeons are removing testicles for tuberculosis. There was a time when I did it. I sometimes now resort to castration in these cases, but only under one of two conditions. The first is when the disease is confined to one testicle, and when, after a most careful examination of the mouth and throat, the lungs, the intestinal tract, the prostate, bladder, kidneys, the skin, and the bones, not finding any lesions that can be detected by our modern methods of diagnosis, I am satisfied beyond any reasonable doubt that I am dealing with the primary focus of the disease; without question, without hesitancy,

and without regret, I deprive that individual of his diseased testicle, exactly as I would deprive him of a diseased kidney under similar circumstances. If, however, I find any tuberculous lesion in any other organ, I know that I should be practicing unjustifiable surgery in removing that testicle — surgical work which I should condemn if done by myself, just as I should condemn it if done by any other person.

The other condition is that in which the disease is acute, rapid, and explosive; when caseous degeneration attacks the secretory structure and it rapidly breaks down, softens and destroys the surrounding tissues, and shows conclusively by its progress that no portion of it can be saved by any conservative measures. Even then it is always with regret that I operate, because I have a distinct doubt in my mind as to its efficiency as a probable preventive of a general infection; for, from experience, I know that in such cases the vas and the vesicle upon the same side are already the seat of the disease. Conservative surgery is usually applicable to tuberculous testicles. There is a principle not to be forgotten in these premises: tuberculosis is, of all the infective diseases, the one that most frequently gets well even under the most adverse circumstances.

The clinical experience which I obtained while working in the post-mortem room with Weichselbaum at the hospital *an der Wieden*, when a student, made a deep impression on me. It was a very rare thing for us to find a subject that was not either actively affected with tuberculosis in some one of its organs or showed its healed lesions. When, added to this, came the protest of my dead friend Chismore of San Francisco to my removing the testicles from a tuberculous subject in whom he and I were both interested, and which mutilation his veto prevented, and I later saw this individual get rid of what seemed to me to be a hopeless tuberculosis infection, I changed my views with relation to radical treatment of tuberculosis of the testicles, and became optimistic as to the possibility of the restoration of the functions of these organs, even when they were seemingly beyond possibility of repair. This was many years ago, and I have lived long enough to add a great many cases to this experience and to be thoroughly convinced that one should be very conservative about this species of surgery.

People are cured of tuberculosis of the lungs, and of the bones, and of the skin, and of the organs of the abdominal cavity — why should they not get rid of tuberculosis of the testicles? Even if the conditions are such that one is obliged to do a surgical operation upon such testicles, why should they be removed *in toto*? So long as any portion of the secreting structure of the testicle remains within the body, just so long will the function of copulation be preserved to the individual. This is not a matter of indifference. When one has tuberculosis of the testicles, the removal of this organ protects society from the propagation of a race that only keeps up tuberculosis by its weakness.

But I will direct your attention to the fact that we are not acting for the race. Our services are sought and demanded by the individual, and it is our business as surgeons to act for the welfare of this individual who is looking to us for the exercise of our skill; if we can conserve this individual in such a condition that the genital function is preserved, along with the other functions of his body, we have, in my opinion, exercised the highest attribute of medical and surgical skill. If we can only preserve the ability in that individual to copulate, even if we have to sacrifice his power to become a progenitor, we have still accomplished a work that is an excellent one for the individual; because it is a well-known belief that the testicle, like all other glandular organs, has an internal secretion which is of value in conserving the balance between the different animal functions.

Tuberculosis of the testicles commonly commences in the epididymis and is frequently confined thereto. It is quite easy to remove the epididymis and preserve all of the testicles to which an undiseased vas may be coupled up; or the epididymis and its diseased vas may be removed and the healthy testicular substance still be retained; or the epididymis

and the diseased portion of the vas and the portion of the testicle which is tuberculous may be resected, and an attempt made to preserve the healthy or apparently healthy substance of the remaining portion of the testicle, if a sufficient blood-vessel supply can be retained for this purpose.

I assure you it is rather wonderful what one can do with such a testicle. I have now a patient who had both epididymi removed in Chicago some five years ago; neither gland was tuberculous, and he presented then no tubercular foci in the prostate, or bladder. This man was married at the time and had a child; he has continued in happy marital relations ever since, and both he and his wife state that these relations are regular and entirely satisfactory; but there have been no more children. He ejaculates a fluid that has the appearance and odor of normal semen, and contains abundant leceithin granules, but no spermatozoa. He states that the sexual feeling is as strong as it ever was and that the orgasms are perfect. I have observed several cases of this kind, and quote this one simply because all of the circumstances attendant upon it are so fresh in my mind. This man now has tuberculosis of both kidneys, but both testicles appear healthy. The bladder is not yet diseased, though there is some irritation about the mouths of both ureters, and the catheterized urine from each kidney contains tubercle bacilli. Such being the case, what would have been the use of depriving this man of his testicles and thus preventing the five years of happy life he has had? He is not the subject of tuberculosis of the kidneys because his testicles were not removed five years ago, but because he has the soil upon which the tubercle bacillus thrives, and his kidneys have become infected for this reason alone.

I have another case that is a still more remarkable proof of the value of conservative surgery as applied to tuberculous testicles. One of my patients, a man of 48 years of age, has had tuberculosis of the lungs at intervals since 1901, with intervening periods when he was apparently in perfect health, with the lesions of the lungs cicatrized. In January, 1906, he was attacked suddenly by an acute tuberculous infection of the left epididymis. Within a week after the appearance of the first nodule the gland became painful, enlarged rapidly, and a few days thereafter was adherent to the skin, broke down, and discharged itself through multiple sinuses; the scrotum became red and a destructive ulceration rapidly took place in it. On January 25th I removed the testicle, almost all of the scrotum on the left side, and the vas as far as it was diseased, which was within three ccm. of the seminal vesicle. The vesicle itself did not feel diseased, either through the rectum or the abdominal wound. No attempt was made to close the wound; it was left open, dressed with iodoform and balsam of Peru, and exposed to the X-ray every other day for two weeks. The wound healed in a month.

In January, 1907, the right testicle was attacked; this process was very much slower. From the beginning the entire epididymis was affected; it became large, swollen, and hard and within two months formed adhesions to the scrotum, from which adhesions multiple sinuses communicated with the epididymis. There was no suppuration, but there was a sticky discharge, clear and thin. There was very great pain, apparently neuralgic, at the inguinal ring. On March 15th, for relief I removed the entire epididymis and the vas which was also diseased to within a few centimeters of the seminal vesicle. There was no evidence of any bladder irritation and nothing could be palpated in the vesicle or the prostate on this side. After the removal of the epididymis it was found that about one-fourth of the testicle at its upper extremity was the seat of a tuberculous gumma that had not yet broken down. This was resected carefully, the tunica albuginea being preserved, as it was not adherent to the gumma and was not involved in the growth. The wound was left open and packed with iodoform gauze.

Early in April a necrosis of a portion of the adjoining tissue was noticed, and this part was resected on April 7th; this left a little less than one-half of the testicle, hollowed out and apparently very unpromising. The

edges of the tunica albuginea were brought together over this hollow and a minute strip of rubber tissue drain carried down inside of it. There was no suppuration following, but the wound was very slow in healing. The X-ray seemed to stimulate the infected wound upon the left side to speedy healing, but it seemed to retard the healing of the wound on the right side. The wound was dressed with iodoform and balsam of Peru, and tuberculin was administered every four or five days, in ascending doses of 1–100,000 mgm., but it took about six months before a perfect cicatrix was obtained. Attacks of intra-abdominal neuralgia at the internal ring continued at intervals for nearly two years; they were extremely painful, and resembled attacks of appendiceal or renal colic. They rarely lasted more than a half hour, and always left him completely exhausted. There was never any direct trouble with the bowels or with his digestive organs, so I could not bring myself to believe that the attacks were appendiceal, more particularly as there was never any pain over the appendix upon pressure. Ureteral catheterization and X-ray pictures of both kidneys showed no disease of the ureters or kidneys. At the end of the second year the attacks disappeared and have never recurred since. These were probably due to inflammatory adhesions about the internal ring, for they existed after the disease appeared in the epididymis and before the operation, and he was free from them for a month or two after the operation; then, later, when these adhesions had had time to form again, they recurred with great violence.

Remember, this man has only one-half of one testicle left, but to the sense of touch and to the eye it is a very good one-half, quite as large as a whole testicle is in many men. But the testicle has no vas attached to it. Within six months after the last operation my patient was looking for a woman. He stated that his sexual desire was intense and his gratification was perfect. In 1909 he married, and is still married to the same woman. His tuberculosis of the lungs has caused him to spend his time in the mountains of Mexico or New Mexico, for while there he has no active symptoms. He married because he knew, from two years' experience following the operation, that he could live with a woman in sexual relations. Both he and his wife state that they have intercourse several times a week, and that he has perfect orgasms, but that there are no ejaculations.

Before closing I want to present an illustration of what may be accomplished toward the saving of a testicle that has been fractured or ruptured by direct violence and which would appear to be irretrievably injured, requiring removal.

On May 16, 1912, there was admitted to the Santa Fe Hospital, in Los Angeles, a man of 34, whose occupation was that of a brakeman. This man's left testicle had been injured in a railroad accident on April 5th. Immediately after the accident the left side of the scrotum began to swell and he suffered great pain; there was much discoloration and ultimately great distention on that side. He was confined to his bed in his home in a country town for three weeks, When I first saw him the testicle was about three times the normal size, and the case had been mistaken for one of traumatic epididymitis. Upon my examination on May 22d I saw that the case was one of hæmatocele; and on May 23d, with the suspicion that, following the injury, a sarcomatous change had occurred, I cut down upon the testicle and found the tunica vaginalis filled with half-organized blood clots. There was a large longitudinal tear in the tunica albuginea, through which extruded a mass of necrosed secretory structure, which included a little more than one-half of the glandular tissue of the organ; part of this tissue was dead, and more of it was on the border line between life and death.

I determined to make the effort to save the remaining healthy tissue, and, encouraged by my assistants, resected all of the diseased tissue, hollowing out the structures underneath the tunica albuginea so as to be able to close the wound. The blood-vessel supply was unimpaired, and the tunica albuginea was not necrosed, with the exception of a very small margin on the edges of the wound,

which was resected along with the dead testicular substance. The edges of the wound were then brought together by very fine sutures of No. o catgut threaded into an eye-needle, and the tunica vaginalis resected and a new bed hollowed out for the testicle in the scrotum. The wound in the scrotum was closed, with drainage. The testicles were placed upon a shelf and surrounded by ice caps, which were kept in place for four days. There was no swelling, or inflammation following operation; the drainage was removed on the second day, he was out of doors on the seventh day, and left the hospital in two weeks, entirely well. This testicle to-day has the feel and is approximately the size of a normal testicle, and to all indications and purposes it is so.

It is perfectly possible that, after long months of suffering, the necrosed portions of this testicle would have separated from the healthy ones, and the result would have been the same — that is, the conservation of the healthy portion by nature; but the chances are much larger that if this had been left to nature the testicle would ultimately have been lost.

These cases are cited merely as examples of what can be done toward conservation in cases of disease or injury of the testicles. I could fill a book with the histories of cases of tuberculosis of the testicles, apparently hopelessly diseased, which have ultimately been restored to good functional use by conservative medical and surgical treatment. The case of syphilitic testicles in which conservative treatment of a surgical nature can be practiced must necessarily be very few. The cases of injury of the testicle in which an effort may be made or should be made to save the organ are not very many. but if both sets of blood-vessels leading to the testicle have not been destroyed, it is well worth while to make the effort, and it is often successful.

I am very well convinced that if Hagner's operation were more often resorted to in cases of gonorrhœal epididymitis, there would not be so many barren men as there are at the present time.

SOME USES OF FAT IN SURGERY[1]

By J. F. BINNIE, A. M., C. M., F. A. C. S., Kansas City, Missouri

FAT has an evil repute, partly because of the inconvenience inseparable from great obesity and partly because wounds through great masses of fat do not heal particularly well, and yet, as we will see, this abused tissue fulfils very useful functions. The most widespread tissue in the body is connective tissue, which serves many functions: it binds various structures together, it secretes various salts and so converts itself into bone, it forms cartilage, and it absorbs oil into its cells until each cell is a small bag of oil and constitutes fat — an extremely light and elastic packing and padding material, which can be reabsorbed and used as food when occasion arises.

Tumors of pure fat (lipomata) are common, and fat may increase locally in tumor fashion, as witness the increase in the omental fat contents of old irreducible herniæ.

In spite of its reputation as a tissue of poor resisting power, fat is well suited for transplantation. In many instances it is undoubtedly the connective-tissue basis of the fat which is of value in the transplant, but in other instances other varieties of connective tissue would be valueless compared to that which is infiltrated with oil.

I. Hæmostasis is often difficult to attain in wounds of the liver and like parenchymatous and vascular organs. Tamponade with foreign material, while useful, has obvious drawbacks. Sutures are liable to tear loose in the friable tissues. Such wounds may be treated by omental grafts in one of two fashions.

(*a*) Choose a fragment of omentum of suitable size and volume, ligate it, and divide it distal to the ligature. The fragment must be more than sufficient to completely fill the wound in the liver. Plug the liver wound with the omental mass in such a fashion that the edges of the wound are overlapped by the omentum. Introduce sutures so that they pass in through overlapping omentum, through liver substance into the depth of the wound, and through the omental plug contained in the wound, to emerge on the opposite side of the wound after passing from within outward through liver substance and overlapping omentum. By perforating the overlapping omentum and the plug the sutures when being tied are less liable to cut through the liver substance. Loewy[1] finds that the omental plug becomes adherent to the raw surface of the liver wound, prevents hæmorrhage, and ultimately becomes converted into fibrous tissue. The exposed part of the plug does *not* become adherent to the intact peritoneum.

(*b*) Boljarski[2] and Stucky[3] have pressed free flaps of omentum into hepatic wounds as plugs, or have spread and pressed such flaps as plasters over raw surfaces such as may be left after a difficult cholecystectomy. If the flap is pressed into its hepatic bed it adheres so well that sutures are unnecessary. In a case reported by Stucky cystectomy was followed by free venous bleeding. Tampons, sutures, etc., failed to stop the bleeding. As a last resort a free flap of omentum was pressed against the raw surface; it adhered and stopped the hæmorrhage. The patient died at the end of three days. The autopsy showed the graft absolutely adherent to the raw surface of the liver but *not* to the peritoneal surface.

A number of hepatic wounds have been successfully treated by omental tamponade. In a case of crushing injury, W. J. Frick (personal communication) found many lacerated wounds of the kidney which bled freely. Other methods of hæmostasis failing, he plugged the wounds with perirenal fat held in place by a suture and secured good results. Mayo, Bastianelli, and others reinforce the suture, closing wounds of the renal pelvis with flaps of perirenal fat, and find them of much value.

After myomectomy the sutured uterine wound may be covered with a plaster con-

[1] Rev. de gynéc. et de chir. abdom., x, 821.
[2] Arch. f. klin. Chir., xciii, 2.
[3] Arch. f. klin. Chir., xcix, 384.

[1] Read before the Clinical Congress of Surgeons of North America, Chicago, November, 1913.

sisting of a free flap of omentum held in place by a few stitches (Mayo). This graft aids in preventing any oozing of blood. The omental grafts placed over intestinal wounds to prevent leakage of intestinal contents are methods of peritonealization and depend for their value entirely on their fibrous tissue constituents and peritoneal covering and not at all on their fat contents; in fact, a very fat omentum, while desirable as a plug for liver wounds, is entirely unsuited to act as a plaster over an intestinal wound. The same is true for a procedure devised by the writer, where he tied a free flap of omentum round the pylorus to permanently obstruct it after gastro-enterostomy had been performed.

II. Traumatic epilepsy is sometimes due to fibrous tissue changes in the pia and to adhesions between the meninges and their coverings (skull, scalp). The usual operative treatment of traumatic epilepsy consists essentially in the removal or elevation of any depressed bone, in the excision of any irritating scar-tissue or of any cystic formations, etc. Endeavors have been made to prevent the formation or reformation of adhesions by covering the cerebral or meningeal wounds with metallic foil, celluloid plates, rubber tissue, Cargile's membrane (prepared peritoneum), egg membrane, hernial sac (fresh or prepared), fascia lata, etc. A successful ward politician of Missouri was in the habit of saying with regard to factions in his own party, "If you can't bate 'em, jine 'em;" so with regard to cerebral adhesions one may say, "If you cannot prevent their formation, make them harmless."

Rehn[1] (in Lexer's Clinic) found that 45 days after a cranial defect had been filled with fat, a clear and distinct basal connective-tissue sheet spanning the dural defect had developed in the transplant. This sheet was elastic enough to permit of expansion and was in no way like the dense connective tissue usually present in cranial defects. In Rehn's experiments the fat flap was spread on the pia, and naturally adhesions could not be avoided, but they were never dense and extended; they consisted of delicate, easily separated fibers of connective tissue except when infection took place, when they were both dense and spread out. The following case may be of interest:

L. A., aged 24; stationary engineer. Admitted Kansas City General Hospital September 26, 1912. On May 13, 1907, a steam pipe, exploding, drove one end of the pipe into patient's right parietal region. He was unconscious for 24 hours. Operation was performed, a number of fragments of bone being removed as well as some lacerated brain substance. When consciousness was recovered there was total paralysis of the left arm and partial paralysis of the left leg. In three months the leg had practically recovered completely; the arm was much improved and continued improving for three years, until now there is merely a partial loss of sensation in the fingers, sufficient, however, to interfere with work. When the patient bends down and rises again there is a painful sense of tearing at the site of injury and there is giddiness. There have never been any convulsions.

Three years after the injury the hiatus in the skull was exposed by operation, scar tissue divided, and the wound closed. As soon as healing was complete the old symptoms recurred. In the right posterior parietal region there is a hiatus in the bone about 1 x 1½ inches in size. When the patient is lying down there is no depression of the scar, but when sitting up the depression is marked. Sensation in left hand is so faulty he can rarely tell the position of the middle finger, and that of the other fingers only with hesitation.

September 28, 1912, Reflection of scalp; excision of scar tissue from hiatus in skull; implantation of enough fat (from the abdominal wall) to completely fill defect. Closure of scalp wound. Healing per primam.

February 4, 1913. The patient is at work. He feels and looks well; can bend to floor and get up again without discomfort. There is now a depression at the hiatus, although two months after operation absence of depression was noted. In March, 1913, the patient reported himself well.

It has appeared to the writer that where a cavity is left in the brain after removal of a tumor or evacuation of a cyst, if the cavity does not quickly disappear through cerebral expansion possibly a plug of fat might be a suitable tampon. The specific gravity of fat is somewhat less than that of cerebrospinal fluid. The writer has had only one opportunity to try the method, and that was in a case of internal hydrocephalus following an old and severe trauma where, during operation, the ventricle was opened under the impression it was a cyst. Failure was a foregone conclusion.

[1] Arch. f. klin. Chir., ci, Heft 4.

III. Many otherwise beautiful faces are deformed by the presence of depressed scars adherent to underlying bone. Sometimes such scars may be neatly excised with gratifying results, but sometimes such treatment is unsuitable or fails. Subcutaneous division of the adhesion between the skin and the bone may do good, but it does not replace the tissues the loss of which was the cause of the depression. If through a suitable incision the adhesions are thoroughly divided, and if then (after hæmostasis is attained by pressure) a suitable mass of fat is gently insinuated through the cut to fill up the depressed area, an ideal result may be obtained. It is best to obtain the fat for transplantation from the patient himself (autoplasty), as homoplasty (i.e., transplantation from another individual of the same species) is not quite so successful and heteroplasty (transplantation from a different species) commonly fails.

IV. After excising the breast for non-malignant disease it is occasionally of considerable importance to reproduce an æsthetic swelling at the site of the mamma. Czerny had occasion to remove one breast and a lipoma from the back of the same patient. Instead of discarding the lipoma he planted it in the bed left by the mamectomy and obtained a good result.

Judd had removed a breast from a woman for non-malignant disease, and almost at the same time he operated on a large irreducible umbilical hernia. From the hernia he obtained a suitable mass of omentum and implanted it at the site of the mamectomy. The graft lived and the cosmetic result was gratifying.

Klapp, in two cases after excision of the breast for benign neoplasm, implanted masses of fat obtained from the patient's own thigh. From one of these patients a morsel of the implant was excised after the lapse of four months and found to consist of living normal fat with wide connective-tissue septa. Hertzler has had success similar to that of Klapp.

V. When disease has been chiseled out of a bone, recovery is very slow unless the cavity left in the bone is obliterated by the art of the surgeon. The aseptic blood clot, iodoformized decalcified bone chips, iodoform starch, iodoform wax, and various other plugs have all been used with greater or less success. Numerous plastic operations, by which pedunculated flaps of bone and skin have been transferred to and fixed in the cavity, have all given a measure of success. Both Chaput and Makkas independently published in 1904 methods by which bone cavities might be obliterated by the implantation of non-pedunculated masses of fat.

Krabbel,[1] from a study of ten cases in Garre's Clinic, comes to the following conclusions:

1. In chronic osteomyelitis without fistula, implantation of fat has made good. If fistulæ are present implantation is contra-indicated.

2. Sharply delimited, easily accessible tuberculous foci are suitable for fat implantation, even when they are situated near the articular ends of the bone. Diffuse tuberculous lesions of bone and widespread disease of the soft parts may only be plugged (with fat) after the most careful and accurate removal of *all* the disease. If healing per primam does not ensue promptly, or if a fistula forms, the implanted fat must be removed at once, because of the grave danger of tuberculosis developing in the implant.

Chaput in 1913 reported to the Societé de Chirurgie of Paris the case of a woman from whom he had removed an osteomyelitic focus eight years previously and in whom he had plugged the bone cavity with a free flap of fat. After eight years of good health a new focus of disease developed near the site of the old lesion, and the necessary operation permitted demonstration of the satisfactory healing in the bone of the transplant of fat made eight years previously.

Makkas' experiments show that it is almost always possible to close aseptic bone cavities with free flaps of fat, even when these cavities communicate with joints. The fat is sometimes changed into connective tissue; sometimes it persists, but the plug is always (Makkas' experiments) surrounded by a new-formed layer of compact bone derived from the walls of the cavity. In one of Makkas'

[1] Brun's Beitr., lxxxv, 400.

three successful cases in man, the cavity was infected with staphylococci.

In extensive chronic osteomyelitis of the humerus with fistula, M. P. Lawrowa[1] reports healing in about three months, although there was "partial wound suppuration."

The writer has made use of fat to fill the cavity left by removal of a metacarpal tuberculous focus and was gratified with the result.

In any operation where an infective focus is excised from a bone and the resulting cavity is to be plugged with any suitable material, it is important to operate in a well-ordered, rather formal, systematized manner. Operation may be carried out somewhat as follows: (1) Remove all evidently diseased or infected tissues and sterilize the wound with pure carbolic acid, neutralized afterwards with alcohol (Harrington's solution or pure formalin solution may be used). Pack the wound with gauze. (2) Let the surgeon and assistant put on clean gloves. Prepare the region of the wound as if for a new operation. Using freshly sterilized instruments, remove the pack from the wound and with chisel or burr cut away a layer of bone from the walls of the osseous cavity. Once more chemically sterilize the cavity and wash away the chemical with salt solution. Pack the cavity. Once more change gloves and instruments. (3) Obtain a mass of fat of suitable size, preferably from the patient himself. Do not touch the fat transplant with the fingers, but lift it in forceps with the least possible trauma. Remove the pack from the bone cavity. Completely fill the bone cavity with the fat transplant. Close the wound without drainage. Only by some such systematic procedure can asepsis be reasonably assured.

VI. *Arthroplasty.* When a bony ankylosis has been divided and the articular ends of the affected bones have been properly modeled, their reunion may be prevented and a new joint may be obtained by interposing living soft tissues between them. Murphy has done very much to develop arthroplasty. In his work (and the writer pleads guilty to the same fault, if it is a fault) he has been careful to use *pedunculated* flaps of fat. To use flaps provided with peduncles complicates the operation considerably, and it seems to the writer that once the flaps are twisted into position the peduncles are of very doubtful value. If free, i.e., non-pedunculated, flaps of fat and fascia thrive in other situations after transplantation, why not when used in arthroplasty? Röpke has been successful in using free transplants of fat, even as large as the hand, in arthroplasty.

VII. After tenorrhaphy or neurorrhaphy it is very important to prevent the line of union from becoming closely adherent to neighboring structures. There is no better prophylactic measure than wrapping a free or pedunculated flap of fat around the part to be protected.

VIII. In pulmonary tuberculosis and in bronchiectasis various operations have been devised to put the lung at rest and to cause any pulmonary cavities to collapse. Artificial pneumothorax or the filling of the pleural cavity with nitrogen, Friedrich's operation of excision of the chest wall, Sauerbruch's and Wilm's operation of extensive rib section causing collapse of the chest wall,—all these are endeavors to attain the same end. Tuffier[2] has successfully grafted voluminous masses of fat between the mobilized parietal pleura and the ribs in bronchiectasis. Paraffin wax of low melting point has been used instead of wax. The same method may be used to close suppurating and tuberculous pulmonary cavities.

[1] Ztschr. f. Chir., 1913, No. 30.

[2] Internat. Med. Cong., Lond., 1913

THE RELATION OF THE DUCTLESS GLANDS TO THE WORK OF THE SURGEON[1]

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DURING recent years I have realized ever more forcibly the growing importance of the subject selected for this address, and therefore I make no apology for its introduction upon this occasion. Those audiences before which I have already discussed some of its phases and aspects have been so small compared with this that a reiteration of presentation of certain of its features previously made calls for none. But before this large and unusual audience, assembled from all parts of our country, it seems desirable to first call attention to certain generalizations essential to a more ready comprehension of that which may follow.

The internal secretions, so often spoken of as hormones, exercise an apparently controlling influence, hitherto but crudely appreciated, on many of the organs and functions, and this not alone on the ordinary body functions, but on the nutrition and regulation of individual organs and their particular activities, even to the extent of becoming responsible for the development of certain mental traits or personal characteristics which may make or mar the individual, and may thus affect both his physical and intellectual welfare.

For example, dwarfing or gigantism, each of which seems due to perverted activity of one or more of the ductless glands, naturally affects the social and school life of a growing child, and to such an extent that when conspicuous deformity results the entire course of life may be affected to an extent which is appalling. Such defects, for instance, as are to be noted in a rachitic child may, by making him an object of ridicule among his playmates, entirely change his nature and disposition, and thus change his temperament and his life work. Such consequences are by no means so indirect as may at first appear. The early effects of hypo- and hyperthyroidism, thymism or pituitarism need only to be better known in order to have this significance better appreciated. So, too, with regard to several of the mental derangements which in time past have brought the young and growing child, the adolescent, or even the adult to the operating table; we may now realize that in their inception, at least, they constitute expressions of over- or underactivity which, had they been recognized early, might have been prevented or at least avoided by a suitable opo- or organotherapy.

Conditions of this sort, then, have led to an ever-strengthening conviction on my part that, even as surgeons, we need to apply the most exact attainable knowledge of the ductless glands and their significance (so soon, that is, as the physiologists furnish it) to our orthopedic and our numerous other cases of arrested or perverted development. And if that most excellent definition of the surgeon be true, which some author to me unknown has perpetrated, namely, that a surgeon is "a physician who knows how to use his hands," then it doubly devolves on us to cultivate this field of research.

So much, then, by way of introduction.

And what, then, are these most important parts of the body that play such a mysterious yet imperious rôle in influencing development and welfare? Our literature is now rich in essays or monographs dealing with the internal secretions, and the recent large works of Biedl and of Falta, superseding to some extent the memorable monograph of Sajous, are monuments to the industry and research of their authors. Continental authorities, German especially, seem to have contributed much more to this subject than have our English colleagues, and it is interesting if not significant that both the recent authors just mentioned are members of the Vienna Faculty. There should, however, be mentioned

[1] Read before the Clinical Congress of Surgeons of North America, Chicago, November, 1913

along with these books the recent excellent work of Gilford.[1]

Take, for instance, the overproduction of adipose tissue — not alone that form which constitutes general adiposis (often dolorosa), but the earlier forms, which in many respects more or less resemble cretinism. These deposits are serious impediments to the welfare of patients, young or old, and produce difficulties well-nigh insuperable in certain surgical cases. To the perverted activity of which ductless gland is it due — pituitary, thyroid, or genital? In relatively few cases can we as yet decide. Still less can we assign to any one of these glands its exact rôle in this complicated and generalized fat deposition.

Still less, too, are we able to fix responsibility on these small organs in cases of retarded mental development, occurring as they do at times in children dwarfed in stature, or again in those of precocious growth; equally uncertain are the reversed features of mental precocity in those of diminished skeletal growth. Imbecility, then, with or without manifestations of cretinism, is, let us say, a frequent result of the perverted development which is ascribed to altered and abnormal hormones.

While surgical operations may then be requisite to meet particular indications, it would be a mistake to subject every microcephalic child to a craniectomy. Such mistakes I have myself made in time past, having operated, as have others, on numerous children belonging to this class with only a modicum of success. The furor for this kind of surgery of the cranium has passed; but a most valuable lesson has been impressed, namely, that we should estimate general and especially hormonic conditions much more accurately before resorting to manualization. The principal argument in favor of such indiscriminate operative work would rest with those advanced thinkers who in such cases see in euthanasia a boon to the race in general and an indirect benevolence to those vitally and parentally concerned.

According, then, to the teleological views of the individual will such efforts as these be favorably or unfavorably regarded. If operative surgery is to be the aim and end of professional endeavor, then the attempt to restrict rather than expand its field will not meet with approbation; if, on the other hand, an operation be regarded as but a means to an end, then every conscientious practitioner will welcome the effort to attain that end by some less hazardous, more promising, and safer course, especially if it be founded on a more accurate apperception of fundamental conditions.

The doctrine, not the theory, of internal secretions was not yet born when, in 1889, Brown Séquard reported his first memorable experiments in a communication to the Société de Biologie. The theory of these secretions was perhaps a hundred years older, and was the outcome of notions according to the old humeral pathology that the blood stream contains abnormal products from various organs; it was the outcome of an analysis of the changes ensuing upon castration, followed by the transplantation experiments of Johannes Müller, who recognized secretory activity in cells and in the membranes and glands composed of them, whose products exercise an internal rather than external and visible influence. Berthold, in 1849, had already proved this by his experiments, though his deductions were not recognized by such investigators as R. Wagner. Claude Bernard was probably the first to accept the doctrine and to use the term "internal secretion."

Of these hormones some are produced from membranes, e.g., in digestion; others are formed within the ductless glands, whose products apparently enter the venous capillaries. To all of these is given the collective name *hormones*, implying thereby their property of acting as stimuli to some other organ or collection of cells different from those which produce them. Their recognition has served to better explain many obscure processes, while at the same time it has complicated our proper appreciation of the multiple and reciprocal activities of various parts of our bodies. Nearly all if not all of the organs and secreting membranes of the body act in

[1] Gilford, "The Disorders of Post-Natal Growth and Development." 1911, London.

this way, i.e., they affect the function of other organs or membranes, although in our present state of knowledge the true blood-forming or blood-elaborating organs (spleen, marrow, lymph-nodes, and hæmic glands) are excluded from this category.

It will appear, further along, that this doctrine relieves the autonomic (or vegetative) or sympathetic nerve-system of some portion, at least, of the work which we have hitherto credited to the "trophic" nerves. Strictly, then, the list of ductless glands should be thus made up:

Hypophysis { Anterior, posterior;
Epiphysis or pineal gland;
Thyroid;
Parathyroids;
Thymus;
Adrenals (medullary portion), and the entire
Chromaffin system:
Pancreas (intertubular cell groups, islands);
Genital glands { ovaries, testes.

To these may be added

Breasts;
Tonsils;
Carotid and Luschka's glands. These will receive but casual if any mention in the present consideration, since our knowledge of their utilities or purposes is yet too vague. This may also be said of the pineal body.

The *embryonic origin* of the ductless glands is of importance, because some of them are of distinctly epi- or hypoblastic origin, others of mesoblastic. The anterior hypophysis is of the former, i.e., ectodermal, while the posterior portion is neurectodermal. The thyroid is entodermal, being developed from the anterior wall of the craniopharyngeal canal and the pharyngeal clefts on either side. It is of interest that both the anterior hypophysis and the thyroid were at one time, and originally, active glands emptying their secretions into the primitive alimentary canal.

The thymus is of essentially the same origin as the thyroid, hence perhaps the peculiar relations between the two. The islands of the pancreas, which interest us in this connection, are also entodermal, developed from pouches formed around its ducts.

The adrenals are of mesoblastic origin, developing from the cœlomic epithelium. The genital glands also are of the same origin. There is, moreover, a striking resemblance in many respects between the cells of the adrenal cortex and those of the interstitial genital glands. The chromaffin tissue, or so much of it as is not included in the adrenals, probably is of ectodermal origin.

Thus it will be seen that all three layers of the developing embryo are concerned in the formation of one or more of these bodies, and that both the genital glands and adrenals are developed from the epithelium of the cœlom.

Here and later it is desirable to emphasize the reciprocal relations obtaining between those organs which have so much to do with the development of the skeleton, and to note how any disturbance of these relations may produce skeletal defects. Even deformities which seem at first trifling may have far reaching consequences from such distortions of the upper part of the body as may indirectly affect nutrition. Quite recently Preiser has described at length the "static joint disease" which leads to faulty attitude, produces inertia, and indirectly affects the life history of the individual. One must not forget, however, that changes from the archetype which were produced by man's assumption of the upright position have brought about many indirect disturbances, especially about the pelvic girdle. The correct architecture of the bony skeleton may be notably perverted in this way, since it has permitted so many visceral ptoses, as well as changes in circulation of the abdominal viscera, that the nutrition of a number, if not all, of the ductless glands has been affected.

A very imperfect and partial list of conditions evidently due to hormonic disturbance would at least include the following:

Acromegaly;
Hydrocephalus internus, resulting from obstructed discharge of the posterior pituitary into the cerebrospinal drain;
Graves' disease, with or without persistent thymus, and even hibernation;

Myxœdema and cretinism;
Tetany;
Thymic asthma and the status lymphaticus;
Rickets;
Achondroplasia;
Obesity;
Addison's disease;
Sexual changes, including amenorrhœa, eunuchism, etc.;
Mental defects of various types — infantilism, mongolism, and the other extreme, mental precocity;[1]
Skin dystrophies, including dryness or the reverse, i.e., excessive perspiration, loss of hair, or other changes;
Neurasthenia of certain types, especially that with moist, clammy skin, bright, restless eyes, glossy hair, exaggerated reflexes, muscle tremors, abnormal hunger, diarrhœa, menorrhagia, insomnia, exaltation of special senses, hot flashes, frequent pulse, etc.

Here the benefit from suitably directed organotherapy is sometimes striking. Thus we are seeing daily, and all around us, instances of perversion of the internal secretions, yet without knowing just how to distribute their symptoms or assign to each ductless gland its part or share in the guilt; we are, therefore, almost powerless to help. Hence it is that we have so often to resort to the therapeutic test, namely, to administer first one and then another of the extracts until we determine which is indicated.

Another most important feature is the evident antagonisms which prevail between certain of these bodies, now one, now another acting as regulator or governor of the production of some other gland; thus, between the thyroid and the genital glands marked relationship is evident, since menstruation may be restored and pregnancy possibly occur after myxœdema and cretinism have apparently been cured by thyroid extract.

Many of the unpleasant features of the menopause are apparently due to hyperthyroidism and may be relieved by administration of ovarian or corpus luteum extract. Again, according to Kidd, the pineal body furnishes a hormone which has marked inhibitory effect on the genital glands. Inasmuch, however, as it undergoes only partial involution at puberty, it may also have some other effect. Little is known of the pineal body, but we may be sure that it has at least some more tangible function than being, as the ancients supposed, the seat of the soul.

Between the thyroid and the pancreas, too, there seem very intimate relations, as also between the pancreas and the parathyroids with the hypophysis and the entire chromaffin system.

The hormones fall into two groups, the *upbuilding* and the *destructive*, while each group exerts an inhibitive effect upon the other. Overgrowth, i.e., gigantism, implies decreased or inhibited disassimilation. Normal growth, i.e., activity, implies an equilibrium maintained. Complicating all these growth features appears the as yet undetermined influence of the nervous system. What difference will later be made in our notions regarding the trophic nerves remains to be seen.

Hormones are by no means necessarily complex chemical bodies; from adrenalin (methylamino alcohol of pyrocate) as one of the most complex, we have simple carbon dioxide at the other extreme.

From surgical experiences much has been learned, e.g., from cachexia strumipriva and ovaripriva and from post-operative tetany; while experimentation has proved invaluable, most of our practical knowledge having come from these two sources. Were it not for a study of the results of removal of the hypophysis and other organs mentioned above, our acquaintance with this subject would be very limited.

Internal secretory organs labor under the disadvantage that they can only expel their products into the blood, since they have no duct. Hence if their secretions become in any way abnormal the blood nevertheless carries them everywhere, and they must either be neutralized or antidoted or the body will

[1] Parenthetically it might be emphasized here that when dealing with cases of this character there is greatest need for combining with whatever treatment may be selected a suitable environment. This is fully as essential as therapy when dealing with defective children. Indeed, in many instances the parents need treatment (educational) fully as much as do their children, their lack of discipline being a conspicuous feature. Isolation or separation of the child from the over anxious and indulgent mother, preferably in a suitable institution, is of paramount importance.

suffer. The liver is our best illustration of a secretory organ antidoting its own output; urea is the main end-product of albumin metabolism, and by means of it the liver regulates itself, altering it to the desirable extent. Cretinism on one hand and exophthalmic goiter on the other furnish illustrations of a ductless gland which has not the capability of regulating its own production. A change, especially a sudden one, in the number of ions of the metals of the alkaline earths (K, Na, Ca, and Mg) causes immediate and notable effects on function. Muscular irritability, e.g., depends largely on the calcium salts, and their presence or absence is the factor upon which depends muscle repose or constant rhythmic contraction. It is secretin, e.g., also, which determines in a way the closure or opening of the pylorus. Such a surgical condition then as pyloric spasm may have much to do with the internal secretion, and hence the value of calcium salts in surgical therapeutics. We may replace a hormone but not a real secretion.

Having spoken of antagonisms, let us mention also similarities. As between the thyroid and the anterior pituitary let us remember that phylogenetically both were once glands with an external secretion, and that they have morphological similarities. Animals deprived of either behave in much the same way; they remain small, evince similar vegetative symptoms, and become ill in much the same way. In acromegalics the thymus often enlarges, just as when the thyroids are overactive. In cretins we often find degeneration of the hypophysis similar to that of the thyroid, and when pluriglandular symptoms appear they are nearly alike.

Between the thyroid and pancreatic islands similarity obtains in that, in typical myxœdema, carbohydrate assimilation is increased and glycosuria occurs, while after disease of the islands the same takes place; in fact, both these conditions prevail after extirpation of either part.

So far as the pancreas and the adrenals are concerned, in that form of chronic alcoholism where the pancreas is involved as well as the liver, we find pigmentation of the skin much resembling that of Addison's disease, and even though the diabetes due to involvement of the pancreas may later subside, the bronzing due to adrenal cirrhosis does not disappear.

There are two methods of approaching or presenting the subject to which your attention is invited:

First, by cataloguing the organs and their functions, and making the attempt to list the morbid conditions due to their disturbance. This may be called the anatomico-physiological method.

Second, by cataloguing the various general conditions under consideration and interrogating the various organs with a view to fixing the blame. This may be considered the clinical method.

Each of these has its advantages and its difficulties, among them this especially — that each is characterized by a most confusing overlapping of facts due to the overlapping of functions. Thus, in the matter of skeletal growth: this apparently is regulated in the very young by the pituitary and the thymus, but that peculiar dystrophia adiposo-genitalis which is the principal feature of hypopituitarism is seen also in hypopinealism and hypothymism.

We will begin with the first method, selecting the more important organs and first discussing them separately.

THE HYPOPHYSIS

As a whole, this is a persistent organ and therefore must have throughout life a continued function. Extracts of the whole gland increase blood pressure, cause uterine contraction, increase peristalsis, lower carbohydrate assimilation, and have a mydriatic effect. Used to excess they cause emaciation, degeneration of the liver, and increased metabolism. Extirpation produces in animals a peculiar cachexia, reduced pulse rate and respiration, fibrillary tremors, and death in apathy and coma.

The hypophysis probably undergoes an epochal overgrowth at puberty. This may have causative results, since it might account for the transient glycosuria seen at that time

and for the marked changes which occur in the sex organs. Conditions simulating hibernation in man often yield to pituitary extract.

Symptoms of impaired activity include local œdemas of the skin and superficial fat anywhere about the body, face, arms, hands, etc., as well as a dry, harsh condition of the skin, with bristly hair which is easily and early lost. The external appearances are very similar to those of myxœdema, while temperature becomes subnormal. Indications of impairment in the anterior lobe include retardation of skeletal growth with excess of fat, delayed ossification as shown by skiagrams, mental dullness and irritability, with transient glycosuria.

Indications of impairment of the posterior lobe include a high tolerance of sugar with resulting though indirect adiposity, polyuria, sexual impairment, with atrophy even to the degree of sexual infantilism.

So marked are the relations of the anterior pituitary and the sexual system that some have even considered parturition to be due to the final accumulation of pituitary secretion. At all events, this latter might account for the glycosuria of pregnancy; moreover, after multiple pregnancies we frequently see adiposity, loss of hair, changes in the skin, and a subnormal temperature, all of which are evidences of hyperpituitarism.

The overgrowth of the pituitary sometimes occurring after typhoid fever or its clinical evidences are to be considered as the result of toxins which stimulate its own growth, as well, perhaps, as that of the epiphyseal bony boundaries, thus accounting for excessive overgrowth after this fever. Something of the same kind is often seen after marriage, when the stimulation of the sex glands seems to extend in a short time to the hypophysis.

The anterior hypophysis discharges its secretion directly into the blood stream; it has, moreover, its own separate blood supply. Its total extirpation in healthy animals seems to prove fatal. It seems to have a very important part in regulating skeletal growth, its enlargement being usually followed by acromegaly and hypertrichosis. It also enlarges during pregnancy, and to some extent after removal of some of the other ductless glands, presumably as a compensatory feature.

The posterior hypophysis has also its own blood supply, and discharges its secretion into the cerebrospinal lymph. When overactive it produces adiposity and changes in the skin similar to those of myxœdema, causing it to become dry, coarse, wrinkled, and furrowed. It has much to do with the sexual system and causes dystrophy and atrophy of the sexual organs. It seems to retard rather than promote skeletal growth. When overactive it leads to a high sugar tolerance, and when underactive to a conversion of sugar into fat, with increase of weight. When enlarged it exerts pressure and may thus lead to hydrocephalus internus. Its extract acts as does adrenalin, is a powerful galactagogue, and increases peristalsis. When overactivity gives way to reduced activity the skin becomes œdematous and characteristic psychic disturbances are met, such as drowsiness, hibernation, even epileptiform seizures.

In brief, the symptoms of dispituitarism may be briefly summarized as follows:

Reduced activity	Adiposity, Sexual infantilism, Skeletal infantilism;
Overactivity	Gigantism—type Launois in the young, Acromegaly—type Marie in old.

Pinealism may simply be mentioned here as characterized in children by abnormal growth, including that of the hair, obesity (adiposity), drowsiness and precocious (premature) sexual development, all of which may suggest the existence of tumor of the pineal body, or at least of overgrowth. In these sexual traits there would seem to be an antagonism between the pineal, which causes premature development, and the hypophysis, which causes rather the reverse. It includes also hypertrichosis, static irritability, oculomotor paresis, and hydrocephalus internus (pressure?).

The enlargement of the hypophysis during pregnancy is of peculiar interest and has only recently attracted attention. It pertains mainly to the anterior lobe, which at-

tains sometimes a size two and one-half times greater than the normal, while of this increase in bulk at least four-fifths appears to be made up of new-formed cells; in fact it is occasionally large enough to make pressure on the chiasm and thus seriously compromise vision, even to the extent of temporary blindness, which, as all know, sometimes occurs during pregnancy. It is accompanied by noticeable changes in other parts of the body, especially the upper, such as formation of osteophytes on the inner surface of the skull, deposit of calcium salts about the upper jaw, nose, temples, and ridges, and an entire change of facies, including thickening of the nose and lips, and even enlargement of the glands, all of which are most suggestive of acromegaly; in fact, March has reported a case of outspoken, acute acromegaly occurring during pregnancy.

To be more descriptive and complete, the symptoms of involvement of the hypophysis include the following, which are usually distinct and definite enough to aid generally in localization: Severe, persistent headache, due to increased intracranial pressure, particularly well marked when the body is large enough to press upon the optic nerves, and especially in the upright position. Exophthalmos, which is not outspoken and is due to pressure upon the veins (Cushing), along with trigeminal neuralgia, with fullness and tortuosity of the veins of the scalp. These symptoms are often accompanied by adenoids. Skeletal overgrowth, including gigantism and acromegaly, between which a distinction is certainly to be made. Massolongo's epigrammatic generalization that "acromegaly is delayed gigantism" has been quite generally accepted, as well as that of Launois and Roy that "gigantism is the acromegaly of subjects whose epiphyses are not yet ossified as they should be at their respective ages." However, we must emphasize that not all giants are acromegalics, and here perhaps may come in the important distinction between the gigantism of pituitary origin and that chargeable to the thymus.

Skeletal undergrowth, infantilism, and the like pertain to very early, perhaps to prenatal, influences. We must distinguish between the infant dwarfism of Lorain and true *nanism*, where only certain morphological proportions persist or are retarded. The former is in fact best termed *miniaturism*, where the development is throughout symmetrically retarded. We have also to distinguish between *ateliosis*, or perpetual youth, and *progeria*, which means an anticipated old age. This distinction is of course easy. We must also remember Herter's type of infantilism, which is really due to a chronic intestinal infection, as well as the experiences of others who have shown that by feeding young animals isolated proteins alone actual growth is inhibited, although body weight seems to be maintained.

As between the hypophysis and the sexual glands there seem intimate relations. The result of castration is increase in size of the pituitary. Fischera and others have shown that in capons and oxen the hypophysis is often double the size of that in cocks and steers. Jutaka Kon has observed the same enlargement in bodies of castrated women, while others have reported it among the Skoptsy.[1]

If there be truth in all this, then some of the popularly dreaded results of castration in women may be ascribed to hypophysial enlargement and to other phenomena which follow it. While all of this seems rational and is certainly interesting, Falta nevertheless takes exception to it.

Influence of the Ductless Glands in General on Growth and Development

In youth a loss of the genital glands leads to overgrowth of the truncal skeleton, while the cranium does not seem to grow so fast. The distribution of fat about the body is disturbed. Epiphyseal consolidation in those locations where it naturally occurs least or last is delayed. This will account for the overgrowth, and it is not necessary to seek for its cause in the pituitary. The sexual glands, especially at puberty, exert a marked influence over the development of the bones during the last portion of adolescence.

The thyroid, when early lost or reduced

[1] Ziegler's Beitr., 1908, xliv.

in size or when it has suffered involution, seems to cause dwarfism or limitation of growth in every dimension. The fontanels remain open, the root of the nose sinks in, and enchondral as well as periosteal ossification is delayed.

Early involvement or defect of the hypophysis is also followed by limitation of skeletal growth, but not so marked as that due to defective thyroidal influence. In some respects it is harder to distinguish, but when the hypophysis is involved development of the genitals and the interstitial glands is even more marked. Acromegaly in the young is accompanied by more than marked eunuchism, and its secondary sex characteristics are more pronounced.

As between dystrophy of hypophyseal origin and true infantilism, it is to be noted that in the former the mind is but slightly affected, while there is frequent headache sometimes with vomiting, and that in the latter the mind is of infantile type and headache and vomiting are uncommon.

Only when the ideal type or model throughout the body is maintained can we assume a perfect harmony of action between these various glands. Departures from the standard can often be ascribed to or found in disturbed relations or, possibly, perceptible or even visible alterations.

Infantilism

This name was suggested by Lasegue as descriptive of the persistence of infantile conditions and growth into the years of adult life. Its first accurate description was given by Lorain, and the first good case record is that of a 24-year-old female dwarf, by Dancel and Baillager.

The type is susceptible of further classification; for instance, Brissaud describes a form which he considered due to early thyroid infantilism as distinguished from the Lorain type, which to him is due to a general and complete retardation, arrest, or defective development, in which no one particular organ is at fault.

Perhaps the best classification of types of infantilism is that offered by Anton, and is as follows:

Infantilism with myxœdema and cretinism;
Mongolism;
Infantilism due to inactivity of the genital glands;
Infantilism with primary disease of the visceral glands, namely, thymus, adrenals, and pancreas;
Dystrophic infantilism due to
  Vascular insufficiency;
  Primary brain lesions, of one or both hemispheres;
  Hereditary syphilis;
  Alcoholism and other poisonings (habit or occupational), or by inheritance;
  Early and precedent tuberculosis, chlorosis, or cardiac lesions;
  Starvation, bad food, environment, or faulty position (as in school), typhoid, malaria, pellagra, etc.

To these Falta adds

  Infantilism due to partially defective activity of the genital glands;
  Infantilism of true psychic origin (whatever that may be).

Schüller would make but two principal types, namely:

  A dystrophic type, due to hereditary or prenatal, i.e., very early, influences;
  An acquired type, due to distinct abnormality in one or more of the ductless glands.

In all of these forms there is subinvolution of the entire lymphatic apparatus, while ossification proceeds irregularly and body proportions are either reduced or altered. Our perception of irregularities of ossification has been made possible only by use of the röntgen rays.

Dwarfism

Dwarfism differs from infantilism in this, that symmetry of development is not maintained, and is to be distinguished from true infantilism, for which perhaps the best name is *miniaturism*, of which Paltauf gave probably the best careful description in 1891. In dwarfism the infant is normal at birth, after which it may assume either of two distinct types, or perhaps an intermediate form. These are:

Primordial nanosomia, where the changes begin at or before birth; and

Infantile nanosomia, where they begin in infancy or early childhood.

To these might be added:

Rachitic dwarfism, combined with ordinary manifestations of rachitis, while mentality is not affected and the sexual system is normal; and

Achondroplasic dwarfism, combined with abnormal ossification and hyperplastic exhibits at the epiphyseal joints, clubbing, etc. Here periosteal bone formation may be excessive and deformity of skull and spine often occurs, as well as too early synostosis of the cranial sutures.

Mongolism

This type was first described by Langdon Down, deriving its name from the resemblance in physiognomy to that of the Mongolian races. It is characterized by a small skull, with a round, small fissure between the eyelids which has an oblique direction (sometimes with epicanthus); nose small and even button-like, with sunken root or bridge; small mouth, with disproportionately large tongue, often visible in repose, and cracked; protuberant lower jaw; hair soft and silky; eyes small, and the external ear somewhat triangular in shape. The thyroid is visible and palpable. The cranial openings persist, and the teeth are defective. Ossification is nearly normal. The skin is smooth and soft and general adiposity is frequent. The pseudolipomata of infantile myxœdema are not present. The genital development is usually normal, and mentality is rarely seriously impaired.

Gigantism

In this condition, as differentiated from acromegaly, it is difficult to state just where abnormality begins, but it is usually with evident disproportion or disturbance of the normal symmetrical type, sometimes accompanied by disturbance of function, as in eunuchism. So far as types are concerned there are practically but two — the *eunuchoid*, which may be described as infantile, early or late; and the *potent* type, in which the sexual function is not disturbed. Little is required in this description save to remind that, as a rule, giants are short-lived. Gigantism is usually accompanied by overactivity of the adrenal system.

Differential diagnosis as between dystrophia adiposogenitalis due to influences relating to the hypophysis, as compared with that form pertaining to defects in the genital glands, may perhaps be assisted by the following presentation:

Hypophysis at fault:	*Genital glands at fault:*
Usually accompanied by symptoms of brain pressure.	There are no intracranial symptoms.
Reduced carbohydrate metabolism.	No changes noted.
Early closure of epiphyses.	Epiphyses ossify later.
Little alteration of body proportions or dimensions.	Dimensions reduced (height and width together); gynecomasty in severe early cases; in some of these growth may cease.[1]

THE THYROID

Even to-day there is much to learn concerning the functions of the thyroid. It was once regarded as a reservoir by means of which blood pressure in the brain was equalized. It seems to have an influence on the formation of the blood slightly resembling the action of the spleen, possibly vicariating for it. The most important part of its work appears to be elaboration of *iodothyrin*. Certainly iodine is its most important constituent, and in this the thyroid is richer than any other organ. In effect, or accurately speaking, this is really an iodothyroglobulin, which forms a large part of the weight of the thyroid (from one-third to one-half), and even three-fourths of the weight of colloid goiters. In goiters quite free from colloid the thyroglobin contains no iodine, and in hyperplastic (exophthalmic) goiters it is reduced in amount, while in the latter the phospho-albuminoids are increased. (Thyroidin may be made by

[1] Very recently the French have been describing several types of gerodermia, meaning thereby that appearance of the skin which we consider especially characteristic of old age. (Feindel, Paris Médical, 1913, Oct. 18); and an Italian, Ciauri, in a recent volume, distinguishes the following forms:

Gerodermia pseudo-acromegalic, including a hereditary form;
Senilism pseudomyxomatous;
Gerodermia genito-dystrophic, with infantilism in other respects;
Senilism, with feminism;
Gerodermia genito-dystrophic among women.

Among other notable features he describes and illustrates a peculiar appearance of the integument of the face remarkably resembling that of the skin of an orange deeply pitted.

boiling the thyroid for several hours in a 10 per cent solution of sulphuric acid and extracting the residue with alcohol.) E. Cyon thought iodothyrin was formed rapidly when the thyroid is flushed, and that it stimulated the regulator nerves of the heart and thus relieved the blood-vessels, permitting their expansion and thus reducing blood flow to the brain.

The thyroid seems to regulate or lessen deposition of fat and, by regulating those organs which if overactive seem to retard it, to permit normal growth to occur. It seems also to exercise a general regulator control over most of the other ductless glands, less so upon the adrenals than upon others. It affects especially the vegetative nervous system — that is, the sympathetic. Its hormone reacts on the very nerves which supply it, stimulating the vasomotor and perhaps inhibiting the pneumogastric. Between it and the female generative system exist most intimate relations, since it increases in size during menstruation and pregnancy, and even sometimes on deflorescence.

Its true purposes have been made known as much by the consequences of its removal as by experimentation. Of these, one type appears promptly and is characterized especially by muscular spasms and tremors and by many other features; and the other type slowly, in which type nutritional changes, cachexia, etc., appear. There also occur intermediate or transitional forms.

By experimentation it has been shown that extirpation of the thyroid in the carnivora causes early death, and among the herbivora, chronic cachexia. Later it was found that the parathyroids were essential even in the herbivora, and that if they were all removed any animal, even man, would die. Thus it was demonstrated that the thyroid itself is less important than the quartette of small parathyroids. In general, then, regarding the function of the thyroid it may be said that its final product is a hormone which is passed into the blood as an iodo-albumin, and that this modifies the activity of several other organs; thus it promotes catabolism and increases normal function. It helps in the disassimilation of a number of substances by producing others which affect the heart, the sympathetic nerves, the hypophysis, and the adrenals. It promotes skeletal growth and the development of the sexual glands, and it limits the internal secretory function of the pancreas. Whether this is done by direct contact with the tissue elements of the organs affected or through the mechanism of their nervous supply is as yet uncertain. For example, it may affect directly the sexual apparatus or by influencing the pituitary. Opinions differ as to whether there is more than one thyroid hormone, but at present the sentiment of the physiologists is in favor of a single hormone.

In any discussion of this subject we must not omit from consideration the fact that the thyroidal function may be more or less disturbed by the toxins of a chronic intestinal infection, especially in infants, which may thus result in disturbed relations in the whole ductless gland system.

Symptoms due to removal of the thyroid appear in at least 70 per cent of cases after extirpation, and Kocher has placed seven years as the possible duration of life after complete thyroidectomy. When these symptoms do not appear their absence must be due either to accessory thyroids or incomplete removal of the main body. Cachexia may appear even after partial removal, though in mitigated form. Horsley thought at first that six-sevenths of the entire thyroid might be removed with safety, but Kocher places it at three-quarters; while a spontaneous recovery from symptoms is possible, this must be due to hypertrophy of the remaining portion, which may even be regarded as a form of autotransplantation. On the other hand, even when an apparent abundance has been left the remainder may undergo such degeneration as to cause cachexia. We must not mistake every thyroidal enlargement for true goiter. It may be due to really degenerative changes with suppression of true function. We must not forget Kocher's statement—"there are goiters and goiters."

In the young and growing animal the most constant evidence of thyroid insufficiency

is disturbance in growth, shown by retardation in length and height (that is, dwarfing), due to imperfect ossification, with sexual infantilism and retarded puberty, and often also by arrest of mental development, with impaired intelligence, clumsy locomotion, and the general conditions suggestive of cretinism. Adults show lassitude or inertia, muscular asthenia, mental inactivity, waxy, thick, and puffy skin with consequent immobility of the face muscles and lack of expression, anæmia or subjective sensations of chilliness, œdematous mucous membranes in the pharynx, nose, conjunctiva, etc., and they complain of pains in the limbs and joints. Menorrhagia is the most frequent of features peculiar to women, while during pregnancy all the above signs and symptoms are intensified. Sterility is the rule in both sexes.

The relations of Dercum's adiposis dolorosa to the thyroid are far from clear, though the lassitude and mental apathy just mentioned, sometimes with psychic exaltation, are suggestive in spite of what we have learned regarding the hypophysis; nevertheless, the enlargement of the latter, with atrophy of the genital glands, may point to a diverse etiology.

Much stress has been laid on the fact that senility is characterized by atrophy of the thyroid along with many other changes. The latter are so numerous as to make it uncertain whether thyroidal atrophy is a cause or result, but there is much in the typical senile condition of the skin to suggest it.

Hypothyrosis includes infantilism, then, but comprises much more. It was Virchow who brought into prominence certain ethnological features and who introduced the terms *nanosomania infantilis* and *primordialis*, subsequently accepted by Paltauf and others. In the former the young child, after having a fair start, ceases to grow. In the other, dwarfing is due to arrest almost at the outset. In the former the babe is of normal size at birth, but at some later yet early period ceases to grow. In the latter it is a miniature even at birth, yet may attain a sort of completeness, with complete ossification and sexual maturity. Some great men have apparently been of this type. Adults of the infantile type have been described as appearing like ordinary men and women viewed through the wrong end of an opera glass (Dayon).

In achondroplasia there are no characteristic mental defects, but the body displays striking disproportions, such as shortness of limbs and relatively greater length of trunk and head. Its most pronounced pathological feature is defective epiphyseal union.

Mongolism implies arrest of natural growth, with abnormal growth of cranium and facial bones; depression of nasal bridge, open fontanels, thickened tongue, defective sexual development, and notable mental abnormalities, apathy, somnolence, and later a perfectly unreasoning bodily activity. The eyelids assume an oblique angle; the skin shows few if any changes. The bones develop naturally. The thyroid is usually normal, and thyroid feeding is of no benefit. Alt and Schüller believe mongolism to be in fact a primary dysgenitalism.

THE PARATHYROIDS

Only within late years have these four little bodies been given their proper consideration, and in this short time have attained an importance in pathology quite disproportionate to and in inverse ratio with their size. It is now generally believed that nearly all cases of tetany in man are of parathyroidal origin, and due to defective function and consequent evidences of hypoparathyroidism. Even that form of tetany occurring in the puerperal state is to be explained in the same way; in fact it would appear that pregnancy may provoke an outbreak of this kind or of a condition previously latent. It is now well known that the tetany of infants is often due to hæmorrhages, i.e., apoplexies into these little bodies. Tetany of so-called gastrointestinal origin is difficult to explain, but must be due to a suppression of parathyroidal activity due to some toxic products elsewhere produced.

It is of interest that Fleischmann found that among those who had had an earlier history of infantile tetany the teeth showed a marked defect in their protective enamel covering. It is known also that the parathyroids succumb easily to tubercular infec-

tion; hence, perhaps, the frequency with which the Chvostek phenomenon, i.e., facial spasm from a tap on the outside of the face, may be produced in tubercular patients.

THE THYMUS

The thymus seems to have much to do with the development of the entire bony system; when its activity is reduced ossification is much interfered with, and proceeds irregularly and from scattered points. Sometimes it fails utterly, as when the first pair of ribs fail to ossify, and the others are left weak and subject to early deformity. When this happens the sternum is usually disproportionately wide; the bones all lack in mineral constituents and become so soft that they may even be cut with the scissors; later this softness and flexibility may give way to fragility and brittleness. The larger epiphyses (hip and knee) may still be cartilaginous when the shafts are already brittle. In animals thymectomy produces osteomalacia, as well as an osteo-arthritis much like that met with in rheumatism or tabes. The hair undergoes changes and becomes either very soft and downy (hypertrichosis lanuginosa) or the reverse, i.e., stiff and bristly. Corresponding defects in dentition occur, the teeth being really epithelial products as well as the hair. There are other accompanying congenital defects, such as rudimentary uterus, mammæ, etc.

Peculiar relations obtain between the thymus and the genital glands, since it persists much longer after castration, while its removal is often followed by a hypertrophy of the external genitals. Redlich's case of infantile gigantism had this peculiarity.

The thymus seems intimately concerned in the production of the *status lymphaticus* and the so-called *thymic asthma* in which conditions along with hyperplasia of the thymus itself, goes an accompanying participation of the entire lymphatic system, including the tonsils, the follicles of the tongue, stomach, intestine, and spleen, which are all lymphoid structures, while the bone-marrow becomes very red. In these cases there is defective development of the genital system. The entire chromaffin system seems to suffer from hypoplasia, as shown by low blood pressure due to defective adrenalin secretion.

The relations of the thymus to the conditions known as achondroplasia seem very positive, though not very distinct. This condition is one of irregular dwarfism, in twelve cases of which Jensen found the hypophysis reduced in size. The explanation would include in general those dwarfs who in time past have been made court jesters or court fools, and have played no small part in history. It is a curious fact that the ancient Egyptian deity, Ptah, is represented as a dwarf with crooked legs. The term achondroplasia was devised by Parrot, who in 1876 was perhaps the first to ascribe to it an identity of its own. It may, moreover, include such defects or deformities at the base of the skull as to stand in relation with changes in the hypophysis.

Cranial defects are common, and spinal curvatures may often accompany the condition. When an infant dwarf is raised by lifting it under the arms it usually cannot be made to sit up, the relatively large head cannot be maintained in proper position, and the efforts usually made to prop it up result in these curvatures.

Basal pressure between the second and eighth weeks of fœtal life affords a tempting explanation for some authors. This may be effective, either within or without the skull, or may be made so by the almost doubled-up position of the fœtus *in utero;* or it may occur within the amnion, from hydramnics — in other words, from lack of space accommodation. Whatever deformity is produced by participation of the amnion occurs within the first six or eight weeks of intra-uterine life. Amniotic pressure may produce deformities purely mechanical, or by a disturbance in the very early stage of bone formation. Jensen[1] believes also that narrowing or limitation of the amnion is a factor transmitted by heredity in many families, and that numerous teratomata are ascribable to this influence.

Naturally, when pressure is made cartilaginous structures suffer most; and its effects may be seen, for example, in the very flat

[1] Zeitschr. f. orth. Chir., xxxii, 1.

noses of some new-born infants, also in harelip, micrognathy and agnathy, hydrocephalus, etc., as well as in defects of the thyroid and thymus as the sheer result of pressure, the order of phenomena being about as follows: Increased amniotic pressure; deformity of the embryo; pressure effects upon the hypophysis, thyroid, and thymus, and consequent disturbance of their functions and perversion of their secretions.

Both Hochenegg and Kocher have reported most illustrative cases showing how, after removal of the anterior hypophysis, there is reduction in dimensions, the hands and feet rapidly becoming notably smaller. If achondroplasic dwarfism were due to overactivity of the hypophysis the cranium would show overgrowth, as do the long bones and the lower jaw, but this condition does not appear until after birth; moreover, in acromegaly and gigantism the sexual instinct is lowered or lost, as it is not in achondroplasia — rather the contrary. By these facts, then, we may the better decide as between responsibility of one gland or the other.

Jensen regards it as probable that the future will demonstrate that these changes in the jaws, hydrocephalus, harelip, and the expressions of athyroidism and athymism, are due to abnormal curvature of the embryo owing to a diminished amniotic space; that the gas cysts formed in these inner organs are due to increased hydrostatic pressure; and that adiposity and increased sexual activity are to be ascribed to the secondary and indirect pressure effects of such displacement, by which the posterior hypophysis is affected.

Summing up the conditions ascribable to amniotic pressure, we have first to appreciate that the overstretched amnion is capable of causing pressure on its contained embryo sufficient to affect its secretion and influence its shape and position, even to a degree permitting important alteration in many respects, and that by diminishing blood supply a general dwarfing may be produced. Individual peculiarities of each case will determine its prominent features, but cartilage and bone both suffer early and variously, while in consequence thereof alterations are manifested in the viscera and in the ductless glands. The achondroplasiac is therefore an amniotic dwarf, so conditioned during the earliest weeks of its amniotic life, and there is scarcely a limit to the abnormalities and effects which may result therefrom.

Curvilinear compression, then, due to such pressure, predetermines the deformities, internal and external, of the achondroplasiac, the extent of which is a measure of the time and extent when and to which pressure was first made, while teratomata are but extreme manifestations of the same kind.

THYMUS AND THYROID

Increasing attention is being paid to the interrelations of these two bodies in that symptom-complex known as exophthalmic goiter. The more closely we study it clinically the more composite seem its features and the more interchangeable, at least in some respects. In fact, so sharply are the German pathologists[1] differentiating between the two that they speak now of Basedow-thyroid and Basedow-thymus. Undesirable as are these terms to us, it may be that we shall have to accept them until better English equivalents are offered. Certain it is that undue activity of one seems to excite the other, the reverse being equally true.

The effect on animals of the injection of their juices or transplantation of their tissues is much the same. Gudernatsch, in certain feeding experiments, fed one set of animals with thyroid and another with thymus; with the former he produced dwarfing, with the latter the contrary, but the former could be overcome by thymus feeding. It is found in man that the mildest type is that in which apparently only one organ is involved, while extirpation of either one alone leads to a reduction in the degree of symptoms of either type, along with a reduced lymphocytosis. It would therefore be tempting to regard each organ as having its own secretion, with its own distinct type, were it not for the effects of adrenalin, which seem to indicate quite the reverse and to disprove their completely separate character. Moreover, their embryology would argue against their complete separation. Anatomically, the cylinder cells

[1] Capelle and Bayer. Beit. z. klin. Chir., lxxxvi, 509.

of the thyroid are regarded as concerned with the sympathetic system, and the polymorphous cells as evidencing the vagus capacity of their component tissues. Tandler and Gross have observed persistence of the thymus among the Skoptsy, while others have noted increase of development of the genital glands after thymectomy.

Again, between the thymus and the entire chromaffin system, including the adrenals, there exists a marked interrelation, since with insufficiency of the latter, as in Addison's disease, goes increase in size and activity of the thymus.

The *adrenalin test* is applicable to all cases in which it is desirable to make it. It is necessary before making it to determine the clinical intensity of the symptoms, the blood picture, and the renal elimination as to glycosuria and polyuria, and the relation of the latter to perspiration, specific gravity, etc., since, according to Saardermann,[1] the more intense the symptoms the more pronounced are the reactions. He advises to inject 0.001 of adrenalin, in two sittings, at intervals of one-half hour, although to some this would appear heavy dosage. In struma simplex with one-half of the patients, at least, there will be no reaction and no glycosuria. In all cases perspiration will cease, while only rarely is there subjective sensation of heat. In patients not above 20, if sugar be present at all it is so in but slight amount. At ages from 20 to 40 there is usually some trifling polyuria, and with it perhaps a small percentage of sugar. After 40 the test is less distinctive, and there is diminution in one or the other, or both; or both may be lacking.

In exophthalmic goiter adrenalin causes more marked perspiration, with palpitation and tremors. When glycosuria and polyuria as well as perspiration are greatly increased, then we may regard the sympathetic system as overloaded, while reduced perspiration indicates a much milder form. When perspiration is entirely lacking and the skin is dry it shows that the pneumogastric is overworked. In the latter group of cases lymphocytosis is diminished, sometimes even within a few hours after the adrenalin is given.

[1] Ztschr. f. exp. Therap. u. Path., xii, Heft 3.

THE ADRENALS AND THE CHROMAFFIN SYSTEM

These are the only members of the ductless gland system which have not, to some extent at least, been considered as quite legitimate field for surgical endeavor, the instances of attack upon these bodies being very rare, and under peculiar pathological conditions such as are seldom duplicated. Nevertheless their reciprocal interrelations with the other ductless glands are just as interesting and just as important. When the adrenals are removed in rabbits the hypophysis enlarges; their medullary portion is the most vital, and its hormone enters the blood via the suprarenal veins. This secretion preserves the tonus or equilibrium of the nerve-centers of the heart and blood-vessels, as well as of all the respiratory muscles — possibly, indeed, of the entire muscular system.

The cortex belongs, properly speaking, to the chromaffin system, and is capable of assuming, at least to a small extent, the work of the medullary portion, while after removal of the latter it undergoes hypertrophy. Adrenal insufficiency causes asthenia, apathy, muscular atrophy, and finally paralysis, shortly prior to death. It causes also pigmentation. In some roundabout way it may lead to hydrocephalus internus, since in five cases of this condition Czerny could find no medullary substance.

Insufficiency may be produced in consequence of acquired or congenital atrophy, hypoplasia, and cirrhosis, or it may, on the other hand, be the result of local tuberculosis, syphilis, or tumors. No matter what the active cause, pigmentation is always an accompaniment and serves to differentiate diseased conditions.

The pigmentation noted during or after pregnancy, as seen along the linea alba and at the umbilicus, labia, nipples, face, and "chloasma uterinum," as well as increased growth of hair, even formation of a beard, are to be ascribed to the adrenals. Sometimes the excess of hair is lost after delivery. Halban demonstrated much the same thing in animals after shaving their abdomens; he ascribes this to the adrenals, which he found to enlarge during pregnancy.

THE VEGETATIVE SYSTEM

This is a term now in quite general use, comprising what we used to call the sympathetic and possibly the trophic nerve-systems. It was introduced by Kundrat. Disturbance of this vegetative system implies developmental retardation not directly ascribable to primary lesions in the ductless glands.

The term *vegetative* includes also the visceral nervous system, the ganglionary and autonomous system, and the three great plexuses which Gaskell has described as the cranio-cervical, the thoracic-columnal, and the sacral, along with Auerbach's and Meissner's ganglia and the fibers which they receive from the other system and from the anterior roots after they leave the spinal cord. This system supplies all the glands having ducts, as well as all the involuntary muscles and the muscular organs, including the heart, bronchi, alimentary canal, gall-bladder and ducts, bladder and ureters, the pelvic organs, the small hair muscles, and the blood-vessels. These ganglia have been happily spoken of as "switch-boards," and some of the nerves pass through two or three of them. It includes also the oculomotor, chorda tympani, the vagus, and the pelvic nerves, which as a group have been called the *vagus group*. It should perhaps be emphasized that the sympathetic and the vagus groups are more or less antagonistic. The tendency to-day is to look more to this so-called vegetative system and the hormones and less to the trophic nerves for explanation of various phenomena under present consideration.

The entire chromaffin system, and especially the medullary part of the adrenals, is under control of this system, and bits of chromaffin tissue are scattered throughout the sympathetic nerves. The actual material secreted by this system, no matter where found, is adrenalin. After extreme muscular activity the chromaffin cells lose for a time their chromaffinity; in other words their adrenalin is consumed (Schur and Wiesel), and the amount of adrenalin in the blood serum is increased. This means that during their activity a large amount of glycogen is used, melted down; that is, the mobilization of glycogen is governed by the chromaffin system.

Pluriglandular Disease

Under the term pluriglandular, implying obviously the participation of two or more of the ductless glands in the etiology of a given morbid condition, the French especially have introduced a term which is convenient, and yet fraught with some danger — danger, that is, to our clearer comprehension of the nature of the diseases under consideration. Yet underlying this danger is a generalization of truth and fact which, in order to avoid one, needs a candid statement of the other.

This basal fact is that the ductless glands actually are so complex in purpose and function, and their interrelations so complicated, that in many instances, in order to identify the organ primarily at fault, we are in sore need of much more accurate knowledge of function as well as an earlier study of cases, than is usually permitted us. Many of these cases wander from family physician to specialist, and then back again; the former is perhaps too concerned with the general fact that the patient is really sick, while the latter interrogates mainly the particular organ in which he is especially interested. Thus by the time the patient comes under observation of the really competent "universal specialist" the clinical picture is so diversified that a proper location of the primary fault is well-nigh impossible. It is the old story:

The centipede was happy, till one day the toad, in fun,
Said, "Pray, which leg comes after which?"
This excited him to such a pitch
He lay quite helpless in the ditch,
Not knowing how to run.

Once the habit is formed of simply recognizing a pluriglandular disorder as such, all scientific accuracy is put aside, and therapeutic efforts assume an experimental or empiric character which impairs rational and well-directed effort. Whatever, then, of benefit accrues from such treatment, while welcome, is not conducive to accurate advice. Let us, then, acknowledge that while disturbances of really pluriglandular type occur not infrequently, we must yet make effort to trace symptoms to their primary, i. e. their real, source.

Falta's definition or description of what should be the real nature of a general condition entitled to this designation is well founded and should be generally accepted. By this term he would imply a condition due usually and originally to an infection which may or may not be traceable, involving almost simultaneously more than one of the ductless gland system, leading to well-marked atrophy, usually of the sclerotic type, and without apparent reason for such selection. In this possible involvement the thyroid, hypophysis, adrenals, and the genital glands usually figure, and we accordingly find evidences of thyroidal and pituitary insufficience, sexual impairment, combined perhaps with symptoms reminding one of Addison's disease, such as debility, pigmentation, and the like. Most conspicuous and almost universal is cachexia, pronounced, but of ill-defined type.

The infection underlying this vicious circle may be of various types. Gonorrhœa and syphilis are perhaps no more likely to be followed by the condition than typhoid, influenza, or tuberculosis; in fact the latter figure prominently. Too often one of these has preceded the other, so that accurate history is impossible to secure. Claude and Gougerot have gone so far as to postulate a congenital or inherited weakness of the entire gland system as a contributing cause, or as so reducing resistance that a comparatively trifling temporary or short-lived infection may easily result; all of which is self-evident. Alcoholism may also be mentioned in this connection.

Gilford's[1] and Jonathan Hutchinson's *progeria* and Variot's *senile nanism* are types which pluriglandular disease may produce. These writers both describe cases remarkably similar in their diminutive stature, extreme emaciation, thin, wrinkled, and almost folded skin, small lower jaw, slender bones with premature ossification, clubbed bone ends, and congenital retardation. Gilford ascribed the trouble to the hypophysis, Variet to the adrenals. But, as Falta shows, the premature ossification may have been due to a separate cause; their normal mentality speaks for thyroid insufficiency, while the infantile distribution of hair may have been due to adrenal insufficiency or even to mere atrophy of the skin.

In all this consideration we must not forget that the ductless glands may have been congenitally defective, and that we must not always ascribe all secondary changes to their perverted secretions.

As Gilford[2] says, "By experimental study alone we are lost in the mazes of abstract science, while by clinical research alone we arrive at premature and unscientific conclusions." In his opinion we must turn to pathology and study what happens when one or another is diseased. Initial correlations are established with the first penetration of the ovum by the spermatozoön, and continue until the ductless gland system is elaborated. He is compelled (and probably we, too) to assume some faculty of adjustment and subsequent correlation quite apart from either that system or nerve influence. What constitutes the machinery or mechanism of this later regulation is one of our greatest problems.

Osteomalacia

Osteomalacia is a disease evidently due to disturbed internal secretions which at the same time cannot be placed in any particular category because of our still defective knowledge. It occurs mostly in women and appears to be due to excess of ovarian hormones, since it is relieved, improved, or even cured by castration. One puerperal or post-puerperal attack seems protective as against others during subsequent pregnancies. When occurring during pregnancy, castration can be performed without necessarily disturbing it.

It occurs also in connection with Graves' disease, and even along with it and tetany combined. Cases have been reported where the symptoms of Graves' disease have changed into those of myxœdema, and later again into a puerperal osteomalacia. In this condition the glycosuria, etc., produced by administering adrenalin, and even its effects upon the heart and vessels, are much less pronounced

[1] Gilford. "The Disorders of Post-Natal Growth and Development." 1911, London.

[2] Lancet, Lond., 1913, Sept. 6.

than in other conditions, conspicuously less during pregnancy. As also showing the pluriglandular nature of the condition, certain cases have been improved by the injection of pituitary extract.

Osteomalacia is quite different from rickets in that it occurs sometimes in endemic form, appears only in adults, and is not painful. The so-called rheumatic or rheumatoid form is a misnomer.

Chlorosis

Chlorosis is also a disease, probably of pluriglandular nature, which begins usually at puberty. We naturally seek for its cause in disturbed activity, usually reduced, of the sexual glands, while participation of the other glands, thyroid, chromaffin system, and the bone marrow, is a secondary feature.

THE MAMMARY GLANDS

The question whether the mammary glands have an internal secretion of their own is as yet undecided, but will furnish at least a reason for their mention here.

There are four periods of mammary activity:

The eighth or ninth month of fœtal life;
Period of puberty;
Menstrual period, or the day before it;
Pregnancy.

For all but the last of these the ovary furnishes the impetus.

As between the ovaries and the mammæ there obtains very intimate sympathy. This is a matter of daily experience among women, but is noted in disease conditions; for instance, the fact that actual ovarian disease disturbs the mammary function and activity, and that Starling obtained a cactostabile substance from the ovaries which, when injected into non-pregnant animals, caused enlargement of the mammæ and even lactation. Moreover, menstruation often causes sufficient mammary activity to lead to secretion of colostrum previous to the period and even of milk after it, while there is sufficient trophic activity at puberty to produce very significant development of gland elements.

While pregnancy naturally gives the greatest impulse to the breasts, it is not necessary here to invoke the ovaries, since there are a number of cases on record where castration shortly after conception has not prevented enlargement and lactation.[1] Furthermore, transplanted breasts have yielded milk.

Milk formation goes with the termination of pregnancy, even with miscarriage, whether premature or at term. Consequently some have held that the fœtus itself furnishes the hormone which stimulates lactation (Starling, Biedl, Foa), while others ascribe it to the chorion epithelium (Halban), since the death of the fœtus does not interfere with the act, but when the placenta dies no milk is produced.

It was a full appreciation of this interrelation which led Beatson to the suggestion of removal of the ovaries in inoperable cancer of the breast, and which has led others to the suggestion of removal of the breasts in order to limit ovarian activity in some extreme cases. A few trials of Beatson's suggestion have led me to believe that it may occasionally be of value.

THE TONSILS

The tonsils have recently been alluded to as "lymphoid structures with a short period of usefulness."[2] These little bodies are not fully developed until the end of the first year, and have a natural tendency to disappear by the end of the seventh, which, however, in our climate does not often occur. George Wright has also shown that the periods of greatest tonsillar activity coincide with the periods of molar dentition, i.e., second, sixth, twelfth, and seventeenth years, at which last age the "wisdom teeth" are making their appearance. But there may be other reasons for this aside from the conclusion which Wright seems to draw. While the lymph flow seems to be outward, and while it carries an unusually large proportion of lymphocytes, the same interstices through which they escape afford lodgment for bacteria, which latter are not by any means all destroyed by the lymphocytes, acting as phagocytes, even if they can so act, which some deny. Assuming the correctness of the view that tonsillar inflammations are caused rather by their toxins than by the bacteria

[1] Mainzer. "Doppelseit. Ovariot. bei Schwangeren." München. med. Wchnschr., 1895, p. 1117.

[2] Freema. Ann. Otol., 1913, March.

themselves, the tonsillar crypts certainly offer ideal foci for infection. Schönemann painted one side of the fauces with coloring matter and found that the pigment passed quickly into the tissue of the tonsil. He considers the tonsil to be a genuine lymph gland, i.e., like other lymphoid tissue. Good and Sheedy have suggested that the crypts are practically culture tubes in which are carried those bacterial growths by which a protective immunization is afforded.

The tonsils have been characterized as the "sentinels of the body," but are scarcely more protective than is the schneiderian membrane. While they are frequently "ports of entry," they are doubtless a part as well of our protective mechanism. Their hypertrophy is by no means confined to the frail and puny, but is fully as often seen in the robust.

Their real function, be it what it may, pertains to early rather than to later life. Whether they have an internal secretion or not they are really disturbed by secretions produced elsewhere, and, belonging as they do to the inflammable, almost tinder-like lymphoid tissue of the body, a collar of which surrounds every vestigial or embryonic canal, they succumb so easily to infection that they reinforce toxins or hormones produced elsewhere, even though they produce none themselves; while they cause such active and violent participation of other tissues, and they so seriously incommode the patient, that they deserve brief mention here, whether they are actually ductless glands or not.

In conclusion, it will be of advantage to make two brief lists, one illustrating conditions pertaining to the ductless glands in which operation may be considered, and another illustrative of operations which these considerations may require.

CONDITIONS WHICH MAY REQUIRE SURGICAL INTERVENTION

Thyroid — Extirpation, which must be partial, save when dealing with malignant disease; ligation of blood-vessels; transplantation or grafting.

Parathyroids — Here we can scarcely do more than transplanting.

Thymus — Extirpation or transplantation.

Adrenals — Transplantation, or possibly extirpation of one.

Cachexia ovaripriva — Has been relieved by transplantation.

Hypophysis — The anterior lobe may be incompletely removed; very rarely is complete extirpation practicable; transplantation has been attempted so far with questionable success.

Genital glands — May be removed for various causes, but removal is rarely demanded for conditions under present consideration.

Breasts and the *tonsils* — Removal.

OPERATIONS WHICH MAY BE REQUIRED

In general, the character of the operations called for under the various conditions above mentioned include,

Transplantations (thyroid, thymus, adrenal, genital);

Craniectomy and decompression, for consequences of actual synostosis, and consequent microcephaly, etc.;

Operations for hydrocephalus;

Operations on the spine and limbs for various deformities;

Thyroidectomy and ligation of thyroidal vessels;

Thymectomy and operations required by pressure upon the trachea (tracheotomy);

Operations for consequences of osteomalacia, achondroplasia, etc., involving the pelvis (cæsarean section, etc.);

Operations on the teeth and jaws for various congenital defects, cleft palate, etc.

It will be seen, then, that perversion of the internal secretions may produce, directly or indirectly, consequential results which call for a very large and varied list of operations, in the performance of which the surgeon will be required to possess a degree of ability and skillful technique which may tax the resources of the best of us. It is a full appreciation of this fact that really led me into this study and made me feel that the general subject was one worthy of the attention of the physiologist and pathologist working in conjunction with the surgeon, but better yet the well-equipped surgeon should be a good pathologist and physiologist as well as a surgeon.

SPASTIC TUMOR OF THE PYLORIC CANAL AND OTHER SPASTIC CONDITIONS OF THE STOMACH: THEIR SURGICAL TREATMENT[1]

By WILHELM LERCHE, M. D., St. Paul, Minnesota

As pointed out by Erik Müller (1), considerable confusion exists because the various anatomists have differed in their descriptions of the stomach and in the application of the names to the various parts of the organ. This is particularly the case with the pyloric end. A brief review is therefore necessary in order to explain the terms used.

The stomach was first considered a simple sac with an orifice of entrance and an orifice of exit.

To Willis (2), in 1682, is due the first description of the antrum pylori. He described it somewhat vaguely as an antrum *longum et capax* on the right side of the stomach, ending in a small orifice, the pylorus.

Cruveilhier (3), in 1834, gave the following description: About one inch from the pylorus the stomach, bending sharply upon itself forms a pronounced elbow (*coude de l'estomac*), and presents an ampulla which corresponds to an interior hollowing called by Willis the pyloric antrum, by others the small cul-de-sac or small tuberosity of the stomach.

Retzius (4), in 1857, found that the antrum did not have the same shape in all bodies; he mentioned three different forms. The antrum as depicted by him comprises the vestibule and the pyloric canal, which will be further discussed in this paper. Retzius also observed that in the newborn the part of the antrum next to the pylorus formed a short cylindrical tube about 1 cm. long.

Luschka (5), 1863, in his description of the antrum indicates that by this he meant a very small part of the stomach next to the pyloric orifice; Jonnesco (6) thinks that he confounded the antrum with the pyloric canal.

Gegenbaur (7), 1883, described it as a faint bulging on the greater curvature, which on considerable distention shows the antrum pylori.

Jonnesco (6) divided the stomach into (*a*) the fundus, whose lower limit is represented by a horizontal plane passing through the superior border of the cardia; (*b*) the pyloric part forming the inferior horizontal portion of the organ, its left limit being indicated on the lesser curvature by a notch marking the flexion of the stomach, and on the greater curvature by the latter's change in direction. He subdivided the pyloric part into the vestibule and the pyloric canal.

The pyloric vestibule is the small cul-de-sac interposed between the body of the stomach and the pyloric canal. The pyloric canal, first described by Jonnesco (8) in 1895, is the cylindrical part 3 cm. long between the pyloric vestibule and the pyloric orifice.

(*c*) The body of the stomach, or the vertical portion, is between the fundus and the pyloric vestibule.

Erik Müller (loc. cit.), studying the fœtal stomach, found the pyloric canal described by Jonnesco always present, and he adopted the latter's description and nomenclature of the pyloric part.

Cunningham (9), agreeing with Jonnesco and Müller, said that there is no part of the stomach which is more definite and distinct than the pyloric canal, and although it may be somewhat indistinct in adults, it can always be recognized. Its musculature is thicker than that of any other part of the stomach.

His (10) and Froriep (11) accepted the division of the pyloric part after Jonnesco and Müller, but His also proposed a nomenclature of his own.

Forsell (12) suggested the name "canalis egestorius" for the pyloric canal, "sinus" instead of the vestibule, and "fornix" for fundus. He described the canal as being 3 to 5 cm. long.

Beckey (13) found the length of the canal in adults varying from 2.5 cm. to 5.5 cm.; he does not consider the pyloric canal a fixed anatomical structure, but a contraction phenomenon. Wernstedt (14) seems to take a similar view.

Fig. 1 shows an inflated specimen of a stomach that I removed from a woman 26

[1] Read in part before Minnesota Pathological Society, March 18, 1913, and in part before Ramsey County Medical Society, May 27, 1913.

years old, in which the type of a pyloric canal described by Jonnesco-Müller-Cunningham is very well represented. A section through the pyloric part of this in the plane of the two curvatures is shown in Fig. 2.

The stomach walls are made up of three coats — the mucosa with the submucosa, the muscular, and the serous. The muscular coat consists of three layers — the outer longitudinal (thickest along the curvatures, especially at the lesser), the circular layer, and the inner oblique layer. The peculiar arrangement of the oblique layer is illustrated in the schemes of Forsell (15) (Figs. 3, 4, and 5). The latter found by dissection of the muscular layers and from his X-ray studies on the movements of the stomach in healthy persons that a constant and definite muscular architecture determines the characteristic contractions of the organ. According to Forsell the corpus or body of the stomach corresponds to the part between the upper and lower segment slings, as depicted in his diagrams.

Rüdinger (16) found that only the most superficial fibers of the longitudinal muscular layer are continuous with those of the duodenum, while the deeper ones in bundles dip down between the circular fibers of the sphincter pylori, forming arches. They constitute one-third of the thickness of the sphincter and were called by Rüdinger the "dilatator pylori." The balance of the sphincter is made up of circular fibers forming the "constrictor pylori." There is no continuation between the circular fibers of the pylorus and those of the duodenum, there being a connective-tissue septum between them.

Retzius-Gyllenskoeld (17) described a groove or channel along the inside of the lesser curvature of the stomach, which forms by the contraction of the oblique muscular fibers, and through which Retzius thought that saliva and fluids taken by mouth would pass directly from the œsophagus into the pyloric vestibule.

More recently this has been studied by Kaufmann (18), Waldeyer (19), and Lewis (20). Kaufmann observed the canal at postmortem in the human body, and produced it on dogs by injection of physostigmin (Fig. 6).

Hasse and Strecker (21) have described folds of the gastric walls corresponding to the canal of Retzius.

Movements of the Stomach

Wepfer[1] (1679) was the first to study the gastric peristalsis in vivisected animals. He also noticed occasional deep constrictions near the middle of the stomach. Similar observations were made by Schwartz, and later by Haller. Home (23) considered the deep constriction dividing the stomach into a pyloric and a cardiac portion a normal condition during digestion.

Magendie (24) found that the cardiac part acted as a reservoir, holding the food and gradually forcing it into the pyloric part, where the chyme formation took place.

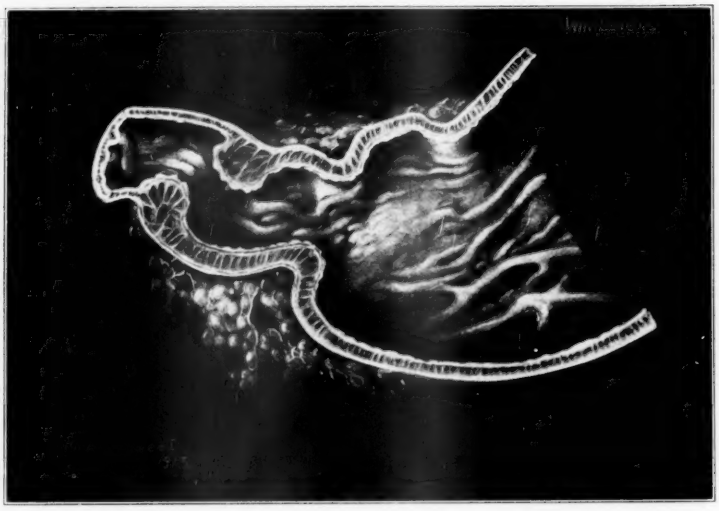
Beaumont (25), between the years of 1825 and 1832, made numerous experiments on Alexis St. Martin, who had a gastric fistula from an accidental gunshot wound. Some of his conclusions were as follows: In health, and when free from food, the stomach is usually entirely empty and contracted upon itself. The food first passes to the left and then along the greater curvature from left to right to the pyloric end, then returns in the course of the smaller curvature and repeats these revolutions, the whole contents being constantly mixed.

He observed the contraction of the transverse band, situated three to four inches from the pyloric end, by introducing a long thermometer toward the pyloric part during the latter stages of digestion. The constriction would relax and the thermometer was drawn toward the pyloric end as by suction and again forced back. Some of these observations were confirmed by Hofmeister and Schütz (26), who studied the movements on freshly removed stomachs of dogs suspended in a moist chamber, at body temperature.

Rossbach (27), studying the peristalsis in dogs in morphine narcosis through the open abdomen, could not verify the rotating motions described by Beaumont.

Openchowski (28) observed the constriction of the stomach in animals during the act of vomiting.

[1] Cit. by Cannon (22).



Section through the pyloric canal and the pyloric vestibule of the stomach of a woman 26 years old in the plane of the two curvatures. See Fig. 2. Two-thirds natural size.

With the introduction of the X-rays in the study of the gastro-intestinal movements, observations could be made under more normal conditions, and the incorrectness of some of the earlier views became evident.

Fig. 1. G, duodenum; H, pyloric canal; A, pyloric vestibule; B, body of the stomach; C, fundus; D, incisura cardiaca (His); E, œsophagus; F, incisura angularis (His); I, sulcus intermedius.

The first results of such X-ray investigations (on cats) were announced by Cannon (22) in May, 1897, and independently by Roux and Balthazard (29) in June and July, 1897. The latter experimented on frogs, dogs, and man.

With the introduction of the large bismuth meal of Rieder (30), in 1904, it became possible to make more exact studies of the gastric movements in man.

Cannon (31) has found that after an ordinary full meal to which was added bismuth

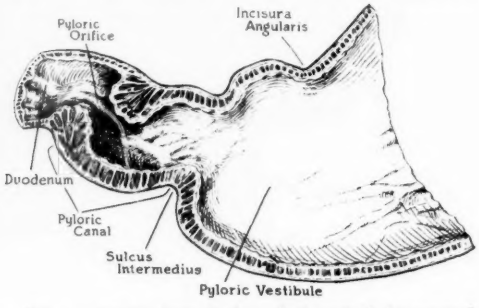


Fig. 2. Section through the pyloric end of the stomach of a woman 26 years old in the plane of the two curvatures.

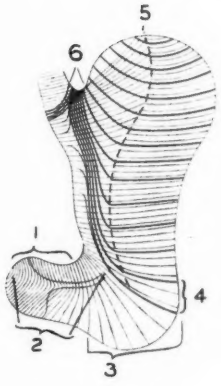


Fig. 3.

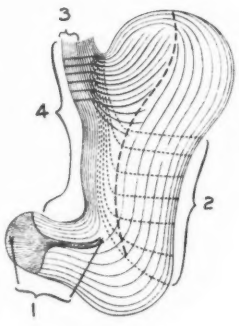


Fig. 4.

Fig. 3. Diagram of the circular and oblique layer. 1, circular musculature of the pyloric canal; 2, ligamentum ventriculi; 3, fan-shaped musculature of pyloric vestibule; 4, lower segmenta sling; 5, line of insertion of the oblique musculature; 6, supporting sling. Fine lines, circular muscle (after Forsell). Heavy lines, oblique muscle.

Fig. 4. Diagram of the longitudinal muscular layer of the stomach (after Forsell). 1, ligamentum ventriculi; 2, body of the stomach; 3, median longitudinal bundle; 4, median longitudinal bundle. Oblique muscle of the corpus, dotted lines.

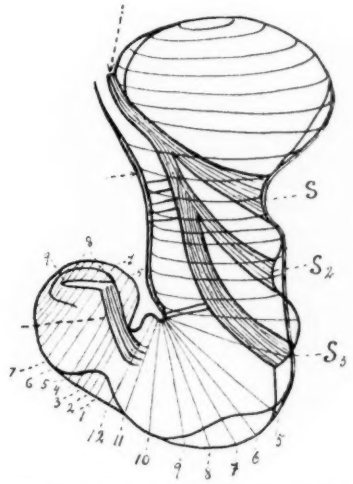


Fig. 5. Scheme showing the modus operandi of some of the muscle fibers (after Forsell).

subnitrate, a slight annular constriction shortly appears near the beginning of the vestibule, which moves slowly toward the pylorus, and later similarly moving constrictions appear near the middle of the stomach. The waves become deeper on the vestibule. The food is held quietly without being mixed in the cardiac part, where the surface layer of food comes in contact with the acid-secreting walls. The ptyalin digestion may thus go on in the center for an hour or more. There is no peristalsis on the cardiac end of the stomach, but this part gradually contracts upon its contents, pressing the acidified layer into the active pyloric part, where in the vestibule it is churned and thoroughly mixed with the gastric secretions by the deep peristaltic waves until the chyme is ready to be expelled into the duodenum (Fig. 7). Acid is not secreted in the pyloric part, while pepsin is. The con-

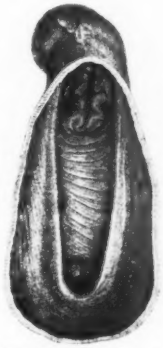


Fig. 6. Interior view of sulcus salivalis of Retzius in a contracted stomach of a dog (after Kaufmann).

Fig. 7. (After Cannon.)

Fig. 8. Superimposed twelve phases of a single contraction of a normal stomach in man (after Kaestle, Rieder and Rosenthal).

tents of the vestibule is expelled at intervals depending upon the condition of the chyme and the acidity on both sides of the pylorus.

The pylorus obeys the so-called "law of the intestines": the acid, when above, causes a relaxation of the sphincter, which is below; and the acid, when below, causes a contraction of the sphincter which is above.

Kaestle, Rieder, and Rosenthal (32) succeeded in taking series of instantaneous radiographs of the movements of the stomach in man. They hold the same view as Cannon, that normally, during digestion, there is no complete separation by a contracting transverse band between the pyloric portion and the rest of the stomach, as maintained by the older physiologists (Fig. 8).

Hertz (33) says that in his X-ray work he has several times seen complete separation, and likewise Kaufmann and Holzknecht (92).

In vomiting the complete contraction has been observed by Cannon. The experiments of Cannon were mainly conducted on animals. The question as to the movements of the human stomach has not been definitely settled yet.

In a recent work Groedel (34), who himself has made extensive investigation, says that there has not yet been sufficient time to arrive at definite conclusions.

ETIOLOGY

Cruveilhier (35) gave a good description of functional pyloric stenosis, and he related a case observed by him in 1822, in which the pylorus was found perfectly normal at postmortem.

It was due to the teaching of Kussmaul (36–37), however, that the importance of the spastic disturbances of the motility of the stomach secondary to organic lesions became better known, and a number of cases have been reported since then. Doyen (38), Carle and Fantino (39), Schirokauer (40), and others have reported such cases operated upon.

The importance of this has been particularly evident of late, since Haudek (41) by his X-ray work was able to show that almost every case of florid gastric ulcer was accompanied by disturbance of motility due to spasm of the pylorus. The pyloric end, the cardia, and the body of the stomach are the parts most frequently affected by spastic contraction.

Gastrospasm, in which the entire organ participates, is said to exist, but Langemak (42) found no case reported up to 1902. Waldvogel (43), on the other hand, thinks gastrospasm a rather frequent occurrence, and Schwarz (44) has recently demonstrated gastrospasm in two cases by the aid of the X-rays. Boas (45) has described, under the name "Magensteifung," spasm of the body of the stomach.

Spastic contraction of the pyloric end is said to be reflexly caused by ulcer, erosion, cicatrix, adhesions, new growth, inflammation, hyperacidity, stagnation of food, foreign body, and the Landerer-Maier (46) type of congenital pyloric stenosis.

Spasm due to primary motor neurosis has been denied by some; but on the other hand it has been argued that if the existence of pyloric insufficiency is admitted, idiopathic spasm of the pylorus should also be. Furthermore, there is no question that we have an analogous condition in the cardiac end of the œsophagus — the so-called cardiospasm.

Riegel (47) says that before we are justified in considering the spasm of the pylorus as a genuine primary motor neurosis we must be able to exclude all perversions of gastric secretions, mechanical obstacles in the pyloric region, all adhesions, cicatrices, etc.

CASE 1. Spastic tumor of the pyloric canal. Resection, Billroth 2nd. Farmer's wife, aged 39; five children. She was operated upon for vesicovaginal fistula and cervical laceration five years previous to the onset of the present trouble; had hay fever for three seasons; has complained of ache in the small of the back for a year. For three months the patient had had a burning sensation and rumbling in the stomach, with dull ache and sharp pains shooting to the back and down the sides of the abdomen. She had noticed a lump in the epigastrium.

Examination. Heart and lungs normal; upper pole of right kidney palpable; uterus retroverted; hæmorrhoids. The abdominal walls were thin and somewhat above the umbilicus was seen a prominence which measured about 6 cm. by 4 cm. The tumor was hard and somewhat irregular and not very sensitive. Gas could be felt bubbling through it. It was perfectly movable. On inflating the stomach with air the tumor slipped to the right of the midline and the greater curvature was about 2–3 fingerbreadths below the umbilicus. Gastric peri-

stalsis was seen. There had been no vomiting. No dilatation. Fasting stomach, empty. After test-meal, 75 ccm.; acid to litmus; no congo-reaction. The tumor was examined and measured several days in succession, and it was always present and of the same size, contour, and consistency. Repeated test-meals showed absence of hydrochloric acid.

Diagnosis. Tumor of pylorus, most likely carcinoma.

Laparotomy. The tumor, which measured about 4 by 3 cm. and was hard as cartilage, disappeared while being examined. A thickening remained in the upper wall near the pylorus, which was patent, and resection of the stomach with a posterior gastro-enterostomy was made.

The patient made a prompt recovery and has had no trouble with her stomach since the operation, which was performed three years ago.

Examination of the specimen showed that even the thickening in the upper part of the wall had disappeared, and there is no scar, ulceration, or tumefaction; it appears to be perfectly normal (Fig. 9). The part involved by the spastic tumor was the pyloric canal. The pylorus itself was unaffected.

Few cases of the spastic tumor of the pyloric end in the adult have been reported. Poensgen (48), who examined the literature from the earliest times down to 1882 on the question "the motor functions of the stomach and their disturbances," even doubted that such a tumor could be possible. In infants, however, a number of cases have been reported since Hirschsprung (49) in 1887 demonstrated specimens and described cases under the name "congenital stenosis of the pylorus." Further investigation has shown that there may be two distinct types — a true organic stenosis, as described by Landerer-Maier (46) in adults, and a spastic contraction of the pylorus: Ibrahim (50), Pfaundler (51), Koplik (52), and Wernstedt (53). The latter examined Hirschsprung's old specimens and found that they belonged to the spastic type, and he says that so far no specimen from an infant has been described that belonged to the Landerer-Maier type, so that probably the majority of the cases reported are of the spastic type. As pointed out by Wernstedt, the mucosa must show an abnormal narrowness in order to prove it congenital.

In two recent cases reported by Rammstedt (54), the evidence of pyloric obstruction commenced respectively five and two weeks after birth. In both cases he made a longitudinal incision of the pyloric tumor down to but not through the mucosa. In the first case he tried to unite the cut muscular wall of the pylorus transversely, but the sutures cut through. In the second case no union was attempted. Both cases were cured. The contracted muscular wall formed a hard tumor 2 cm. long. These two cases seem quite analogous to my Case 1, and could well be interpreted as post-natal spasm.

Scudder (93) cites a case of Koplik's in which, two years after a gastro-enterostomy for obstructive pyloric tumor in an infant, there was recurrence of the vomiting. Scudder regards this as evidence that the pyloric tumor persists and that the stoma is closing. I think that if the stoma is closing it would be evidence that the obstructing pyloric tumor had disappeared after the gastro-enterostomy was made, and that the pylorus had resumed its proper function, thus permitting the stoma to close. The vomiting would therefore indicate "recurrence" of the pyloric obstruction and not that it had persisted. It seems to me that this case rather furnishes evidence that some of the hard obstructive tumors in infants are simply spastic contractions that disappear when the pylorus is functionally excluded. It is probable that the part involved in such cases is the pyloric canal.

Doyen (55) expressed himself to the effect that the pylorus is the dominating factor in the pathology of the stomach, i.e., through the spasm.

The rôle played by the pyloric canal under similar circumstances is not known, but physiologically it is apparently a very active part, and is perhaps often implicated or independently disturbed. As Cunningham puts it, that it has an important action cannot be doubted; its powerful musculature bespeaks the fact. He also expressed the opinion that the musculature of the pyloric canal acts to some extent independent of that of the rest of the stomach, and is under the control of a special nervous mechanism.

According to Forsell (12) the pyloric canal is the apparatus concerned in regulating the

evacuation of the vestibular contents. Cannon says that "at all times (during digestion) in the close neighborhood of the pyloric canal the circular and longitudinal muscles, both of which are strongly developed, probably cooperate to decrease simultaneously in all directions the terminal segment of the stomach."

It seems to me that there is considerable resemblance in the functional activity of the pyloric canal and the epicardia or the lower 4-5 cm. of the œsophagus. Through the œsophagoscope I have seen the epicardia in spastic contraction in a number of cases (56). The only demonstrable abnormal condition about the stomach in Case 1 is the absence of hydrochloric acid, and the question is, may that be the cause of the spasm?

It has been shown by Hedblom and Cannon (57) that hyperacidity retards the passage of food from the stomach, and Katschowski (58) found that after double vagotomy in one dog a gastric juice of 0.7 to 0.8 per cent of hydrochloric acid produced pyloric spasm; in another the spasm was very strong and lasting with an acidity of 0.676 per cent. On the other hand, it is well known that the food, in case of achylia gastrica, may be rapidly expelled from the stomach.

As mentioned above, the longitudinal muscle fibers of the pylorus constitute the "dilatator," and some of these fibers are continuous with those of the duodenum. In case of achylia gastrica the duodenal contents remaining alkaline during digestion would be a constant stimulus to the longitudinal fibers to open the pylorus, while the absence of acid in the pyloric vestibule would have a tendency to keep the pylorus closed, thus upsetting the equilibrium, though ordinarily the pyloric mechanism adapts itself to conditions. However, as achylia gastrica is of relatively common occurrence and spastic tumors of the pyloric canal are very rare, there must be another etiologic factor, so that the explanation herein attempted would hardly suffice. I think that the case must be classified as one of primary motor neurosis. Apparently the balance between the two sets of fibers had been fairly well maintained in my case, as the canal was always patulous and there was never stagnation of gastric contents.

Leg (59), examining a somewhat limited number of cases of achylia gastrica, could not demonstrate hypermotility.

In the table which I have prepared of eleven cases (operated upon) of spastic pyloric tumors found in the literature, together with my own case, will be seen the varying degrees of acidity, and it also shows that the cases with subnormal acidity are in preponderance.

TREATMENT

Pyloroplasty would seem to be the ideal operation in cases of this kind, but Schnitzler had recurrence in his case, which is included in the accompanying table, and likewise in another case of pyloric spasm secondary to ulcer, which he reported in the same paper.

In the case of Brunner's, where hyperacidity was considered the etiologic factor, there was recurrence after gastro-enterostomy. According to Cannon and Blake (67), Kelling (68), Berg (69), and others, the food will pass through the pylorus, if this is patulous, rather than through a gastro-enterostomy opening; hence the failure of gastro-enterostomy unless the pylorus is simultaneously occluded. The necessity of permanent occlusion of the pylorus in such a case is further emphasized by the experiments of Jianu and Grossman (70), who found that if gastro-enterostomy alone was performed there would be no change in the acidity, while if the pylorus was simultaneously occluded there was a marked diminution in the secretion of acid.

Recent experiments of von Tappeiner (71), however, have shown that there is no method of sewing or tying the pylorus that will keep it permanently closed, except that of Wilms (72), who sewed a strip cut from the anterior sheet of the rectus fascia around the pylorus, a method which I have used in Case 2.

The results in the five cases where resection was performed were so uniformly good that the operation seems justifiable (resecting the part involved), but the *exclusio pylori*, whereby the pyloric end of the stomach is cut through and the stumps separately closed, followed by gastro-enterostomy, as first done by Doyen and later by von Eiselsberg (73), may perhaps accomplish the same result.

By whom reported.	Sex.	Age.	Chief symptoms.	Hydrochloric acid.	Diagnosis before operation.	Pathologic conditions at operation.	Kind of operation.	Result.. Remarks.
Schnitzler (60)	F	35	Epigastric pain radiating to back. Vomiting. Tumor.	Not examined	Carcinoma	Spastic tumor; otherwise normal	Pyloroplasty	Recurrence in one year, then gastro-enterostomy. Cure. S. thought it motor neurosis.
Carle and Fantino (30)	M	25	Epigastric pain. Vomiting. Tumor.	High	Fibrous stenois	Slight pyloric hypertrophy; otherwise normal	Pyloroplasty	Cure.
Carle and Fantino	F	51	Epigastric pain. Vomiting. Tumor.	Trace	Carcinoma	Cicatrix near pylorus	Divulsion after Hahn	Improved.
Alberti (61)	M	52	Epigastric pain. Vomiting.	High	Pyloric stenosis	Spastic tumor; otherwise normal	Pyloroplasty	Cure.
Brunner (62)	F	32	Epigastric pain. Vomiting.	High		Spastic tumor; otherwise normal	Posterior gastro-enterostomy	Recurrence a few days after operation.
Schloffer (63)	F	44	Diarrhœa for 5 months, then epigastric pain. Vomiting. Tumor.	Absent	Probable carcinoma	Spastic tumor; otherwise normal	Resection ant. gastro-enterostomy	Cure. The tumor was hard and circumscribed, 1x2 cm., and confined to one side.
Dauwe (64)	F	63	Stomach trouble for years; repeated hæmatemesis. Vomiting. Tumor.	Absent	Probable carcinoma	Pylorus patulous, slightly indurated, adherent to pancreas	Pylorectomy, Billroth's 1st	Cure.
Venot (65)	M	47	Burning pain. No vomiting. Tumor.	Present		Two cicatrices the size of a grain of corn near pylorus. Pylorus somewhat contracted	Pyloroplasty	Cure.
Manasse (66)	M	42	Epigastric pain radiating to the back. Vomiting. Tumor.	Subnormal	Probable pylorospasm with ulcer. Cancer not excluded	Varicose veins about pylorus; otherwise normal	Pylorectomy, Billroth's 1st	Cure.
Manasse	F	55	Epigastric pain. Vomiting. Tumor.	Trace	Probable pylorospasm with cancer	Myoma size of a pea near pylorus; otherwise normal	Pylorectomy, Billroth's 1st	Cure.
v. Bergmann (104)	F	32	Typical ulcus pain; occult blood in fæces. Tumor.	Not mentioned	Probable carcinoma	Spastic tumor, large ulcer	Resection	Result not mentioned.
Lerche	F	39	Burning sensation and sharp epigastric pain shooting to the back. No vomiting. Tumor.	Absent	Probable carcinoma	Spastic tumor; otherwise normal except for a thickening in upper wall, absent in specimen	Resection Billroth's 2d	Cure.

CASE 2. Spasm of the pyloric sphincter. Posterior gastro-enterostomy; closure of the pylorus by sewing a strip of the rectus fascia around it. Female, unmarried, aged 25. The patient stated that her whole family had weak stomachs and were nervous. In childhood she had attacks of vomiting, accompanied by the sensation of distention of the stomach, as if there were a tight band around the waist. She was anæmic in her school-days and had stomach trouble, for which she took soda. She always had to be careful about eating, and never could take butter, cream, etc., and whatever she did eat she could only take in small quantities. There had been several light attacks of pain in the right fossa iliaca. Since November, 1911, her stomach had been particularly bad, and she complained of distress after eating, and belching of gas; frontal headaches, which were relieved on taking soda; constipation, bad taste in the mouth, and a very much coated tongue; at times pain in the epigastrium. In the first part of January, 1912, she had a tooth extracted under chloroform anæsthesia, after which she vomited for a week, and had to stay in bed for a month. After this she was on a diet of peptonized milk, eggs, and scraped beef for almost seven months, but without any relief. She could only take small quantities of any kind of food, and she nearly always felt nauseated after eating; at times she vomited. She had much gas on the bowels. The patient frequently used an enema, which always made her feel nauseated. She could not take cold water.

Examination. Chest and pelvic organs negative; slight tenderness in right fossa iliaca; at times sensitive to pressure in the epigastrium, but at no certain point. Urine, negative. Fasting stomach, empty. After test-breakfast, 150 ccm.; total acidity, 80; free

hydrochloric acid, 45. After another test-breakfast, 300 ccm.; total acidity, 50; free hydrochloric acid, 25. A radiograph taken six hours after a Rieder meal showed considerable stagnation (Fig. 10). The outline of the stomach immediately after the meal is seen in Fig. 11. Ulcus diet and rest in bed were tried, without the slightest relief.

Diagnosis. Possibly ulcer or adhesions causing pylorospasm. Present weight, 85 lbs.

Laparotomy. There was no evidence of ulcer or scar on the stomach or duodenum. The pyloric sphincter was spastically closed; the gall-bladder normal. Posterior gastro-enterostomy was made and the pylorus occluded by sewing a strip from the rectus fascia around it, as advocated by Wilms. Appendectomy.

During the operation I examined the pylorus several times; on one examination only did the pylorus open, and it then suddenly "flew open," so to speak, while I held the firmly contracted sphincter between my thumb and forefinger. It then fairly readily admitted the tip of the forefinger, although it may have been a trifle smaller than normal, due perhaps to hypertrophy of the sphincter. This phenomenon of sudden relaxation of the spasm I have observed through the œsophagoscope once in the cardial end of the œsophagus, in the case of a young lady who had been treated for gastric ulcer, with rest in bed, etc., for three weeks, and during a similar previous attack for seven weeks without any relief whatever. The trouble disappeared within a few days under the administration of atropine.

The absence in Case 2 of any particular point in the epigastrium sensitive to pressure, and the absolute lack of response to medical treatment with rest in bed, etc., was not in favor of diagnosis of gastric ulcer. The remarkable repugnance to fat in any form would have suggested that possibly the gall-bladder might be at fault, causing pyloric adhesions and spasm.

With a history of digestive disturbances of so long standing one could expect to find some evidence if there had been any organic lesion, although positive absence of a lesion could, of course, only have been determined by intragastric inspection.

The case seemed, therefore, likely to be one of primary motor neurosis. The tongue, which before the operation was swollen, beefy red, and glazed, became normal in appearance. The patient became very fond of butter.

CASE 3. Acute pylorospasm and chronic cardiospasm. Posterior gastro-enterostomy; stretching of the cardiac end of the œsophagus. Male, aged 36. Was well up to the age of 27, when he commenced to have difficulty in swallowing, which developed into a typical case of chronic cardiospasm. Five weeks before coming under my care he was taken suddenly ill with violent cramp in the epigastrium. He tried to vomit but could not. Large doses of morphine did not relieve. The man was desperately ill, and his physician referred him to Dr. Lundholm of St. Paul for operation, 48 hours after the onset. The temperature was subnormal; the abdomen was distended, tense, and tympanitic.

Laparotomy performed by Dr. Lundholm revealed an enormously distended tympanitic stomach. The stomach was punctured with a trocar but did not collapse, and an incision was therefore made in the wall of the stomach, after which the organ gradually collapsed. The duodenum was not distended, there was only a small quantity of fluid in the stomach, and nothing else abnormal was found. The incision was closed. Two weeks later the patient had another similar attack and a posterior gastro-enterostomy was made, which relieved the stomach. The cardiospasm, however, now caused him the greatest difficulty; he could hardly get any food into his stomach, and his weight became reduced to 110 pounds.

At this juncture Dr. Lundholm kindly referred the case to me for examination and treatment of the œsophagus. Total gastric acidity 30. Congo-reaction positive. Œsophagoscopic examination revealed a greatly dilated œsophagus and the epicardia in spastic contraction. The epicardia-cardia was stretched. When the patient was re-examined three months later he had gained 44 pounds in weight. Nearly two years after operation the patient informed me that he had had no trouble with his stomach, but coarse vegetables would occasionally pass his œsophagus more slowly than normal; otherwise he was well. I think that there had been a primary atony of the œsophageal wall, with the cardiospasm secondary.

This is an unusual combination — chronic cardiospasm and acute pylorospasm. I have not been able to find a similar case in the literature except the following, reported by Beardsley (74) in 1788. A child commenced to vomit during the first week after birth and kept it up more or less until its death at the age of five years. Beardsley, who first saw the boy when he was two years old, and who made the post-mortem, said that it did not appear that the boy was attended with

nausea or sickness at his stomach, but he often complained that he was choked, and of his own accord would introduce his finger in order to vomit and relieve the choking. He would take large draughts, which at times would become immediately ejected. Autopsy showed a greatly dilated œsophagus, in the walls of which were vesicles or diverticula containing fluid. The stomach was unusually large and contained fluid similar to that found in the œsophagus. The pylorus was hard and contracted. This case of Beardsley's has later been described as a case of "hypertrophic pyloric stenosis." To judge from the post-mortem findings in the œsophagus and the peculiar history of choking without nausea and the taking of large draughts (very likely to force down the stagnating œsophageal contents), there has also been an obstruction at the cardiac end of the œsophagus. In view of what has been said earlier in this paper in regard to the pyloric stenosis in infants, the case might be interpreted as one of chronic pylorospasm and chronic cardiospasm.

There was no evidence of gastric lesion in Case 3, and the cause of the pyloric spasm cannot be positively determined.

Von Openchowsky found that the cortical center for the opening of the cardia is also the center for the contraction of the pylorus.

In Case 3 both ends of the stomach were contracted. Œsophagoscopy showed the œsophagus very much dilated, and the walls gave the impression of being hypertrophied and rigid. Just above the diaphragm to the right the œsophageal wall was especially dilated so as to form a shallow pocket. It is possible that secondary periœsophageal changes had taken place in this neighborhood, which by irritation of the vagus have caused the pyloric spasm.

The following case of Hochenegg's (97) shows the effect of injury to the vagus nerves. A revolver bullet penetrated the thorax of a young girl, producing vomiting, pylorospasm, and enormous distention of the stomach. She made a complete recovery after a gastrostomy which was permitted to close in a few weeks. The conclusion was: some intrathoracic lesion to the vagus or branches.

That inflammatory exudate may disturb the vagus was seen in a case of Küttner's (98). Five days after thoracoplasty for empyema, cough and uncontrollable vomiting set in. Necropsy showed the left vagus embedded in dense pleural exudate and a greatly dilated stomach. Fritsch (99) attributed the cough, vomiting, and dilatation of the stomach to the irritation of the vagus. My interpretation of Case 3 is that there was a primary atony of the œsophagus with secondary spasm of the cardiac end, followed by dilatation of the œsophagus. Whether similar changes took place in the stomach, or whether the acute pylorospasm with gastric dilatation was a result of a periœsophageal irritation to the vagus, there is no way of determining. Gastro-enterostomy would naturally be the operation of choice in this case, with occlusion of the pylorus.

CASE 4. Female, 31 years old; married; never pregnant. Since the age of 15 years the patient occasionally felt a pain about the umbilicus that compelled her to bend forward in order to get relief. She says that it felt as if something pulled, as if something were too short. At times the pain would be absent for two or three months, but then again she might have several attacks in a week.

She had not felt this particular pain for the last seven months previous to consultation. About seven months before I saw the patient she had an attack of pain to the right of and on a level with the umbilicus, which lasted for a day; no vomiting nor fever. A month later she had a similar attack, with which she stayed in bed for a week. Since then she has had more or less pain to the right of the umbilicus, sometimes more pronounced on walking and on turning in bed.

For the last nine years the patient had been distressed after eating, and quite frequently she had a cramp or dull ache in the epigastrium. No treatment or diet had given her any relief. Bowels irregular, moving every two or three days without physic.

A diagnosis of appendicitis had been made and operation had been advised.

For three weeks previous to consultation the patient had been in bed with an attack of diarrhœa.

Examination. A tall, thin woman, stoop-shouldered, and with long, flat chest. Chest and pelvic organs normal. Abdominal wall somewhat rigid and drawn in. Some tenderness to the right of the umbilicus. Temperature and pulse normal. Fasting stomach, empty. After test-breakfast, 20 ccm. of alkaline reaction. No trace of hydrochloric acid after several test meals. Radiograph six hours after a bismuth meal, empty. First radiograph a

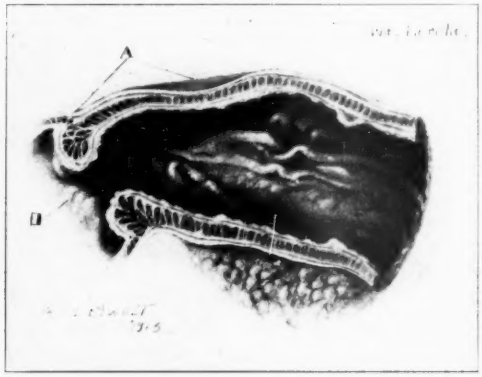


Fig. 9. Resected specimen from Case 1. A, pyloric canal; D, duodenum.

Fig. 10. Case 2. Six hours after a bismuth meal.

Fig. 11. Case 2. Immediately after a bismuth meal.

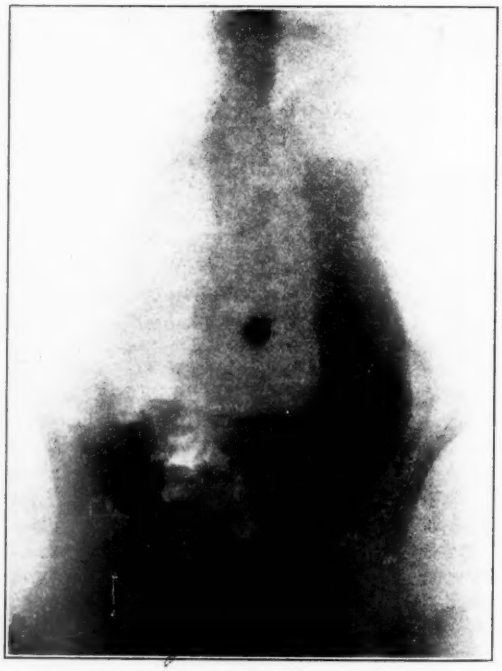


Fig. 12. First radiograph taken a few minutes after a bismuth meal.

Fig. 13. Second radiograph taken a few minutes after a bismuth meal two weeks after the first.

Fig. 14. Third radiograph taken a few minutes after a bismuth meal. Six weeks after operation.

few minutes after a bismuth meal, hour-glass contraction at the vestibule (Fig. 12). Second radiograph a few minutes after a bismuth meal, taken two weeks later, showed a still more pronounced hour-glass contraction of the vestibule (Fig. 13).

Diagnosis. Spastic hour-glass stomach, possibly due to adhesion.

Operation. Through an incision through the right rectus muscle, the stomach and duodenum were examined and no scar, ulcer, or any other pathologic condition found. The antrum of the duodenum seemed to be unusually large. The appendix, small but apparently perfectly healthy, was removed. On sweeping the finger under the abdominal wall a tumor was found projecting from under the umbilicus. On turning this part of the inside of the abdominal wall up, a white tumor was seen subperitoneally directly under the umbilicus. The tumor, measuring about 2.5 cm. at its base and projecting about 2.5 cm. into the abdominal cavity, was removed and found to consist of a sac containing putty-like material and hair — a dermoid cyst. The abdomen was closed. A few days later there was evidence of pus in the abdominal wall. The incision was reopened barely sufficient to insert a small gutta-percha tissue drain, and the pus tract was found to lead to the former bed of the tumor.

The patient told me that for several months she had now and then noticed small quantities of a whitish material come from her umbilicus, so the cyst may have been infected through the umbilicus.

The patient has felt well since the operation, has had no distress or cramps after eating, and has gained in weight.

A third radiograph a few minutes after a bismuth meal, taken six weeks after the operation, does not show any hour-glass contraction of the stomach (Fig. 14).

The question is, Has the tumor had anything to do with the motor disturbances of the stomach? The patient was very thin, and the tumor probably came in contact with the first part of the duodenum, and the direct pressure may possibly have caused the hyperkinesis of the stomach by irritating the duodenum.

CASE 5. Probably cicatrix from gastric ulcer with hour-glass stomach, spastic or combined spastic and organic. Female, aged 41; six children. Mother died from cancer of the stomach. Menstruation at 14. About this age she was pale, weak, and had a gnawing pain in the stomach when it was empty. Sometimes she had pain right after eating, at times

Fig. 15. Radiograph of the stomach in the horizontal position of Case 4 about ten minutes after a bismuth meal. Note tube in the stomach.

half an hour after. She had been bothered with her stomach in this way ever since. She rarely vomited, but at times gulped up food. The pain was felt on the left side toward the costal arch; she had passed bloody urine for some time.

Examination. Patient was very anæmic. A sensitive spot toward the left costal arch. On catheterization of the ureters the blood was found to come entirely from left kidney. Fasting stomach contained some meat and vegetables that she had taken 24 hours previously. On two subsequent examinations the fasting stomach was found to contain food. Several test-meals showed absence of hydrochloric acid.

On inflating the stomach with air and letting it out, there would be a gush of air, after the bulk of it had passed off, by pressing on a prominent part above the umbilicus. The same was observed when water was poured into the stomach. The experiment was repeated a number of times at each sitting. At this period the patient was distressed. The following week the patient was feeling well, and repeated washings of the stomach failed to show any stagnation of food; the above mentioned phenomenon could not be elicited.

With the history of gastric ulcer and with the findings mentioned I suspected a spastic hour-glass stomach, and a few days later, when the stomach again distressed her, I had two radiographs taken. One picture (Fig. 15) was taken in a horizontal position ten minutes after a bismuth meal, with a lavage

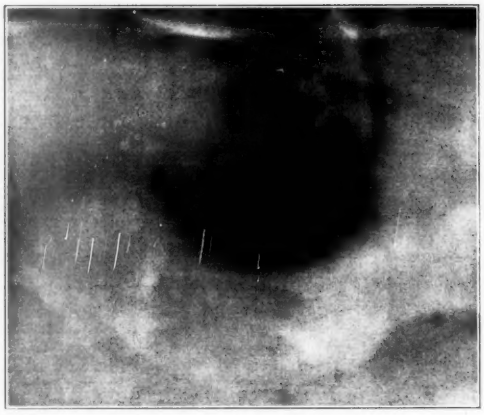


Fig. 16. Radiograph of stomach in Case 4. Taken in the upright position. One hour after a bismuth meal.

tube in the stomach. The rubber tube can be readily seen hugging the lesser curvature or the upper part of the canal of Retzius until it seems to stop in a niche. The fundus appears balloon-like to the left, as it is usually seen when radiographed in the horizontal position.

The second picture (Fig. 16) is taken in the erect position, one hour after a bismuth meal. The fundus is seen sagging down in the upper left corner, and the greater curvature is pulled sharply up toward the lesser. The cardiac part is connected with the pyloric part by a narrow streak of bismuth. The peculiar shape of the lesser curvature will be noted.

I thought that this peculiar form of the lesser curvature might possibly be due to an exaggerated contraction of the oblique fibers forming the sulcus salivalis or canal of Retzius so graphically described by Gyllenskoeld (loc. cit.). This canal may be of great functional importance. Cohenheim (75), experimenting on dogs with duodenal fistulæ, found that if the dog was allowed to drink water or a salt solution after a meal while the stomach was full, the water would appear in quick spurts and almost clear and unmixed with acid at the pylorus; it had passed along the canal of Retzius.

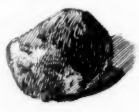


Fig. 17.

Fig. 18.

Pebbles causing pyloric spasm.

Professor Ernest, in discussing this paper of Cohenheim's, said that in people who had swallowed corrosive fluids in small quantities he had invariably found the destruction along the lesser curvature at post-mortem. What relation the function of this canal has to the pathology of the stomach remains to be seen, but we know that the largest percentage of cancer and ulcer of the stomach occur along this tract — the pylorus, the lesser curvature, and the cardia.

Diagnosis. Ulcer or cicatrix on the lesser curvature in the upper half, possibly with perigastric adhesions, but spastic hour-glass contraction alone likely on the basis of cicatricial contraction.

In order to verify a diagnosis of spastic hour-glass stomach it would be necessary to take two or more radiographs at different times.

Operation was postponed on account of hæmaturia.

Hour-glass stomachs are usually divided into the congenital and acquired. Rieder (76) says that very few cases of congenital hour-glass stomach have been reported in German literature, and Cunningham (loc. cit.) and Moynihan (77) both deny the existence of this form.

The acquired hour-glass stomach may be caused by (1) cicatrix from ulcer or corrosives, (2) perigastric adhesions, (3) tumor, (4) spasm and (5) tight lacing is given as a cause by some.

Budinger (78) reported a case in which at operation he observed a spastic contraction of the stomach at the junction of the vestibule with the body. The contracted portion was 4 cm. long and very firm. It disappeared suddenly and reappeared. There were also a few adhesions and a small cicatrix. Schmitt (79) has observed similar spastic contractions at operation.

Since the X-rays came into use in the examination of the stomach, a number of cases of spastic hour-glass stomach, mostly secondary to ulcer, cicatrix, or cancer, have been reported by Rieder (76), Baron and Barsony (80), Haudek (81), Jolasse (82), von Schmieden (83), Stierlin (84), de Quervain (85), Härtel (86), Perthes (87), Hertz (88), and Faulhaber (89).

The importance of the use of radiography in the diagnosis of diseases of the stomach has been well demonstrated by Clairmont and Haudek (90). Of 200 cases in which they had used the X-rays for diagnosis, more than one-third were operated upon, and it was found that no serious mistake in diagnosis had been made.

Stiller (91) claims that the radiograph of the stomach obtained after a bismuth meal is artificial and not a true expression of the real form, but he seems to be the only one of that opinion.

The test of Holzknecht and Fujinami (94), by letting the patient drink a certain quantity of water and take a pair of Kaestle's capsules, after which the length of time this remains in the stomach is ascertained by the aid of the X-rays, may be of value in differentiating between spastic and organic obstruction.

CASE 6. Pylorospasm caused by foreign bodies. Female, aged 16; a native of Vienna, where she lived until the age of 14 years. At the age of 8 years she swallowed 48 pebbles, imitating a performer that she had seen in the circus. The following day she had much pain in the stomach but she did not vomit. She was taken to the hospital (Allgem. Krankenhaus, Vienna, Med. 3), where she stayed for two months. She said that operation was advised but refused by her people. Since then she has had periodical attacks of violent pain, vomiting, and epigastric distention. She said that her stomach would stand out like a football, which was verified by the attending physician. The vomitus was bitter and of yellow color, but only when she had taken anything into the stomach. The bowels did not move during attacks. The last attack was unusually long, having lasted a week.

Examination. A bulging was seen in the epigastrium, which was very tense and sensitive to touch and proved to be the stomach. X-ray examination was advised but refused. She had had four attacks during the last year.

The patient was taken to the hospital, and preparatory to the operation a dose of castor oil was administered, with the result that two pebbles were found in the stools (Figs. 17 and 18). They measured 14x17x10 mm. and 22x15x9 mm. and were quite smooth. Although the patient was feeling quite well a laparotomy was decided upon for the following reasons: Taking it for granted that the patient's history was correct, it seemed to me that the pebbles were rather small to cause so much trouble, because incredibly large foreign bodies are known to have passed the pylorus. An abnormal narrowness of the pylorus or adhesions were therefore thought to have excited the pylorus to spasm.

At the operation a careful examination of the

stomach and bowels failed to disclose anything abnormal, and the abdomen was closed. The patient has had no trouble with her stomach since the operation two and one-half years ago.

One may be reasonably sure that the comparatively small pebbles had caused the severe pylorospasms that the patient suffered from for eight years.

Disturbance in the gastric nervous apparatus is responsible for the spasms, and the cause of this disturbance may either be an organic lesion of the stomach, as in Case 5, which is the most frequent; irritating foreign bodies, as in Case 6; or there may be no demonstrable lesion, as in Cases 1 and 2, the so-called idiopathic spasm. The pylorospasm in Case 3 is very likely idiopathic, but an intrathoracic irritation of the vagus cannot positively be excluded.

It has been quite commonly assumed that hypersecretion or hyperacidity causes pylorospasm, but no evidence has been brought forth to verify the correctness of this.

As mentioned above, Katschowsky found that a gastric acidity of 0.7 to 0.8 caused pylorospasm in dogs upon which he had made double intrathoracic vagotomy. By treating them with soda and milk diet whenever the acidity was above 0.4, he prevented the pylorospasms.

Fritsch (99) in his experiments did not treat his vagotomized dogs with soda to regulate the acidity, and all the animals that lived for some days after operation had greatly dilated stomachs at the time of death. These experiments would seemingly demonstrate that high acidity causes pylorospasm. On the other hand Friedenthal (100), in a dog, cut off both vagus nerves above the diaphragm and nervi splanchnici on both sides. Six weeks later he removed the spinal cord below the fifth thoracic vertebra. The dog had no digestive disturbances and remained well up to two weeks after the last operation, when he died from meningitis. Hedblom and Cannon found that on feeding potato acidified to 0.25 per cent with hydrochloric acid to healthy cats, it left the stomach faster than normal, while if acidified to 1 per cent it left the stomach more slowly than normal. Although these investigators, by the aid of the X-rays, demonstrated retardation in the exit of food from the stomach in the presence of high acidity, they did not observe pylorospasm. It may therefore be inferred that with the nerves of the stomach in a normal condition, high acidity per se does not cause pylorospasm.

Engel (96), in a case of pyloric obstruction in an infant, performed jejunostomy, thereby excluding the stomach entirely. In spite of this vomiting persisted until death occurred three weeks after operation. Engel repeatedly demonstrated gastrosuccorrhœa, and concluded that either the latter and the spasm started simultaneously or that the spasm was secondary. It seems more likely that the spasm and the increased acidity are both expressions of the same stimulation of the nerve.

From the cases in the table and other cases in this paper it will be seen that spasm may be present whether the acidity is high, normal, a mere trace, or totally absent. In the majority of the cases in the table the acidity is subnormal or absent, and in a case of spastic tumor of the pylorus recorded by Schütz (95) there was also no hydrochloric acid present.

The vagus and the sympathetic nerves are antagonistic to each other in their regulation of the motor and secretory functions of the stomach, the impulses through the vagus augmenting these functions, while the sympathetic is inhibitory in its action.

Disturbance in the harmony between the two antagonists may give rise to pathologic conditions, and this question has been studied by Eppinger and Hess (101). By subcutaneous injections of pilocarpine and atropine which influence the vagus system, and adrenalin for its effect upon the sympathetic, they studied the symptoms and effect of the variation in the tonus of the two nerve systems.

Their observations led them to believe that every person who reacted strongly to pilocarpine and atropine was insensitive to adrenalin, and vice versa; that persons who showed strong reaction of the sympathicus after adrenalin injection were not sensitive to pilocarpine and atropine and that changes in the two nerve systems could by these means be sharply differentiated. They

pointed out that there are cases with permanently increased tonus of the vagus nerve, and they observed that gastric ulcer is a strikingly frequent occurrence in such cases.

Although Petren and Thorling (102) and also Bauer (103) found that some cases would react to both stimuli, indicating stigmata in both nerve systems, the tests and this field of study inaugurated by Eppinger and Hess promise to become of great clinical value. Von Bergmann (104) says that cases where only one of the nerve systems is affected could hardly occur — they overlap.

Lichtenbelt (105), in his experiments, found that local spasms of the muscularis mucosa of the stomach and first part of duodenum may cause the formation of ulcer by constricting the blood-vessels that pass through it to supply the mucosa; the part thereby made ischæmic is exposed to the digestive influence of the gastric juice. Rössle (106), on the basis of the study of a large post-mortem material, has attempted to show that the gastric and duodenal round ulcer frequently is secondary to disease of some other organ, and is reflexly brought about through the medium of the nervous system in the way explained by Lichtenbelt. Rössle says all observers agree that stimulation of the vagus causes hypertonia of the sphincter pylori, which may extend into a continued spasm. Thus, by the same stimulation of the vagus the vicious circle is complete, i.e., the local spasm of the muscularis mucosa followed by ischæmia, the spastic occlusion of the pylorus, with retention and subsequent autoindigestion of the necrobiotic mucous membrane.

According to the above mentioned authors and other recent writers the nervous system plays a prominent part in the pathology of the stomach, and the local spastic contraction is primary in the production of ulcer, i.e., primary as far as the stomach is concerned.

In a comparatively small group of cases there is spasm of the pyloric end of the stomach or the cardial end of the œsophagus without any demonstrable lesion or apparent cause, and they (Cases 1, 2, and most likely Case 3) are of special interest in this paper. These cases are termed "idiopathic," whereby is meant that there is no evident lesion to account for the spasm in the organ where the spasm occurs; but well may it be secondary to disturbance in another organ, in the sense of Rössle.

Constitutional predisposition is an important factor, and an individual with increased tonus of the vagus or whose vagus system is hyperirritable may react strongly to a slight stimulus.

The visceral nerve systems are in intimate relation with the internal secreting glands. The products of the latter may stimulate or inhibit the vagus or the sympathetic nerves, and the glands, according to Eppinger, Falta and Rüdinger (107), probably only in this way exercise their influence upon the organs.

Pathologic changes in the internal secreting glands may therefore be an etiologic factor in the spasms under consideration in this paper.

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DEPARTMENT OF TECHNIQUE

A SIMPLE APPARATUS FOR TRANSFUSION BY THE ASPIRATION–INJECTION METHOD

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Mayo Clinic

In rather recent times, transfusion by the method of aspiration and injection has been revived and quite frequently applied. In its favor are simplicity, sureness, and exact estimation of the amounts of blood transmitted. Different devices for the mode of transfusion have been advocated, but all are modifications of apparatuses used years ago (Howe, Colin, and others). Among others, the writer has found that a glass syringe with needle, or its

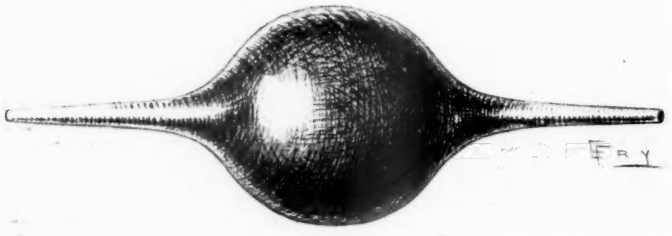

Fig. 1. Rubber bulb (about 30 ccm.) and tips for insertion into vessels of donor and recipient. No Joints.

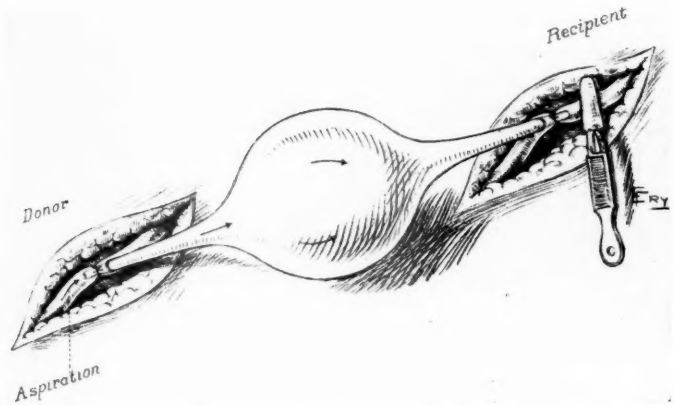

Fig. 2. Apparatus filled with salt solution and tips fixed in vessels by ligatures. Salt solution expressed and serrefine clamp applied to recipient's vessel. Aspiration from donor's vessel until bulb is filled with blood.

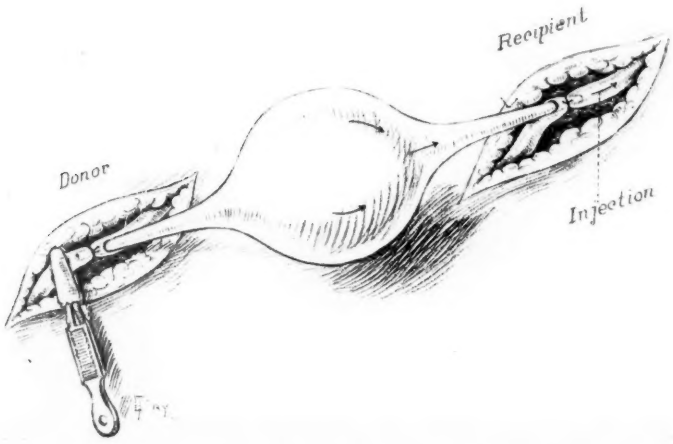

Fig. 3. Serrefine clamp changed to donor's vessel and blood injected into recipient.

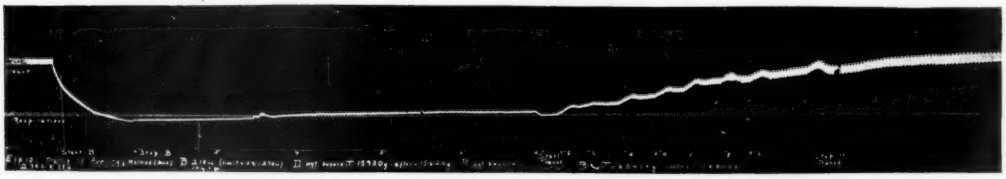

Fig. 4. Experiment bleeding and transfusion. Method, aspiration-injection, with accompanying depicted apparatus. Dogs used for experiment. Tracing of recipient. First half of record shows effect of bleeding 104.3 gms. (weight of recipient 6041 gms.). Second half of record shows effect of transfusion, the blood pressure returning to normal in a series of elevations, each of which corresponds to an injection of blood.

end drawn out to suitable size, is practicable. Anti-coagulants are not essential, and probably are better avoided. The indirect method has opponents, but frequent favorable clinical reports are to be duly considered. The accompanying depicted modification of Aveling's method has proved successful in the writer's experimental work. The procedure is simple and rapid in execution and positive as to results. The amount of blood transfused can be closely estimated as may be seen by the accompanying illustrations (Figs, 1, 2, 3, and 4).

TECHNIQUE OF CLOSING THE ABDOMINAL INCISION

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An article by Dr. J. Wesley Bovée,[1] entitled "The Preferable Technique of Closing the Incision in Abdominal Section and Herniotomy," appeared in 1901. Since that time he has abandoned for his work all suture material except iodine catgut, prepared as described by him,[2] and kangaroo tendon. He has almost entirely abandoned the abdominal bandages after operations, perhaps not using one bandage in a thousand cases, and very rarely employs interrupted sutures.

Of course, since adopting iodine sterilization for the operative field, corrosive sublimate gauze is not used, plain sterile gauze being used in contact with the wound. He has for fully ten years used a true purse-string suture for closing the peritoneum to lessen the danger of intraperitoneal adhesions still more than did the whip stitch previously described by him. When through-and-through sutures were used for closure such peritoneal eversion was studiously avoided, as it was regarded as endangering hernia. With the tier suture it does not create such fear.

A few weeks ago Dr. Bovée learned this plan devised by him was not new, as it had been described and illustrated twenty-six years before[3] by R. Stansbury Sutton, of Pittsburgh. Perhaps it is unnecessary to add that he employs overlapping of fascia in ventral hernia and diastasis recti abdominis. His plan of closing the simple, subumbilical median incision is with five layers of suture, one of which, the main or rectal sheath, is of kangaroo tendon of medium size and the others of No. 2 iodized catgut. The incision is usually made nearly or quite one-fourth of an inch to the right of the median line and after exposing to view the right rectus muscle that structure is separated from the linea alba by blunt dissection and the transversalis fascia divided in turn about one-fourth inch from the linea alba. The peritoneum and subperitoneal fat and fascia are carefully lifted and divided to correspond to the preceding dissection. Almost never are hæmostatic forceps applied to the wound, bleeding yielding to compression with hot, wet gauze.

In closing the incision when it is less than six inches in length, the plan we now recognize as the Sutton method is used. Fig. 1 shows the plan of closing the peritoneum. The peritoneal margin on either side at the middle of the wound is lightly grasped by a small hæmostatic forceps which stabilizes it while the suture is placed. A No. 2 iodized catgut in a curved needle is first passed from without inward through the peritoneum about one-fourth of an inch back of the forceps grasping the edge opposite the operator.

It is made to re-enter the peritoneum about one-fourth inch toward the umbilicus. This plan of weaving in and out through the peritoneum about one-fourth of an inch from the margin is continued around to the starting point. An assistant now carefully draws taut and ties this suture while the operator prevents protrusion of viscera.

The transversalis fascia is closed with the same suture (Fig. 2) which has not been severed, and may be placed in the ordinary spiral form. The peritoneum being more firmly attached in the umbilical region than near the lower end of the incision, it is carried by the purse-string suture to the upper end of the wound and therefore the transversalis fascia is sutured from that end toward the pubes. The suture in that structure is finally tied by the well-known crochet stitch, two stitches being taken and the end pulled through the loop and cut off an inch from it. The fascia forming the external sheath of the rectus muscle is now closed with kangaroo tendon of the medium size, using the lock stitch of the sewing machine for the purpose. This is practically the shoemaker's stitch as employed by Marcy (Fig. 3). It may be placed more rapidly than the shoemaker's stitch as it obviates the necessity of unthreading and threading the needle at every stitch. One end of the suture is fastened into the eye of a needle fashioned after the Peaslee perineal type and the other end is picked up by an assistant. Beginning at one end of the incision, the needle is pushed through the fascia on both sides until the threaded eye is well exposed. The assistant now passes the end he holds through the space between the needle and the suture as they lie closely paralleled and again grasps the free end. The needle is now withdrawn and the stitch is locked.

This process is continued at intervals of one-

[1] Am. J. Obst., N. Y., 1901, xliii, 289.

[2] Am. J. Obst., N. Y., 1907, lvi, 366.

[3] A new method of closing the peritoneal sac after Tait's operation. Gynec., Tr., 1887, xii, 57.

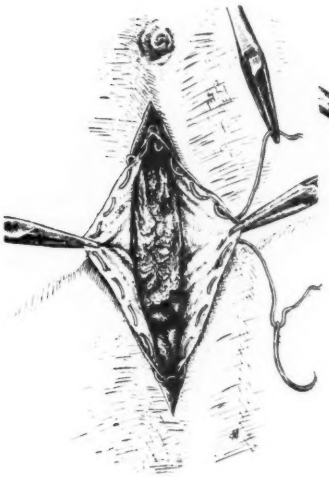

Fig. 1.

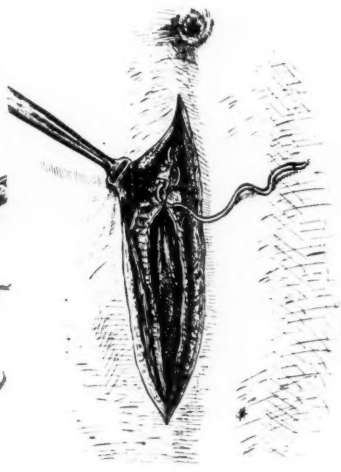

Fig. 2.

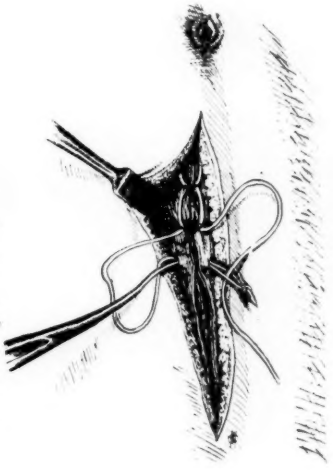

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

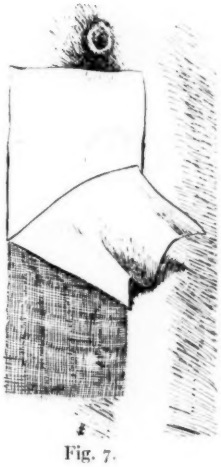

Fig. 7.

fourth to one-half an inch until the other end of the wound is reached and the two ends of the suture tied in a square knot.

The subcuticular fat is now closed by a spiral suture of No. 2 iodized catgut (Fig. 4). The ordinary curved needle with cutting lateral edges is passed through the fascia in the extreme upper end of the wound and instead of tying the suture the free end of it is simply held by a forceps. A spiral suture now closes the fat, care being exercised that the needle lightly picks up the fascia each time it crosses the median line at the depth of the wound. Without securing or severing the suture when it is finished, the same suture material and needle are used to close the skin by a subcuticular suture (Fig. 4) which, when placed, stops at the umbilical end of the wound. The two suture ends, one attached to the fascia and held by forceps, and the other still in the needle, are liberated and tied together and the knot thus formed readily settles to some point between the skin and fascia and is therefore buried. The

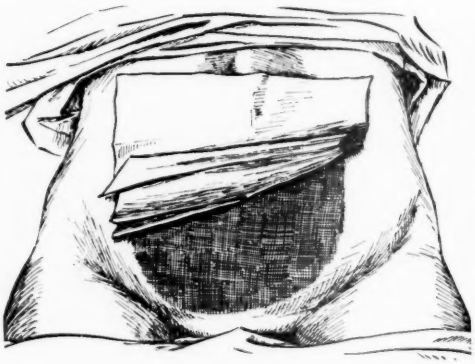

Fig. 8.

cut ends are easily pushed under the skin (Figs. 5 and 6) and we have a wound closed completely and with absorbable suture material completely buried (Fig. 6). When this layer of fat is so thin that it does not need suturing, a different plan is adopted. The subcuticular suture is fastened to the fascia at the upper end of the wound and then inserted. At the lower, or finishing, end it is tied to the catgut closing the transversalis fascia or to the kangaroo tendon closing the fascia.

No effort is made to clean the skin in the field of operation, but a few layers of sterile gauze, two inches wide and two inches longer than the incision, are carefully placed over the sutured wound and in turn covered by a layer of oiled paper (Fig. 7). The abdomen is now covered by a well fitting pad of gauze, six to ten layers, soaked in flexible collodion. Over this a layer of rubber sheeting is placed (Fig. 8) to prevent collodion adhesions between dressings and the clothing of the patient or bedding. An hour or two later, the collodion having dried, this sheeting is removed and the dressing is removed thirteen days after operation — one day before the patient is out of bed. Usually no subsequent dressing of any kind is needed, although a layer of muslin or silk between the scar and corset is advised for a few months.

When the wound is more than six inches in length the peritoneum is closed by a continuous, spiral suturing, the cut edges being turned toward the skin, during the process, sufficiently to prevent their being exposed in the peritoneal cavity.

In very rare instances only are additional interrupted sutures, either single or mattress, used. In all other respects the closure is the same in long as in short incisions. In umbilical or other ventral herniæ, fascia overlapping oftimes is required.

SCALPEL SURGERY OF TUMORS OF THE BLADDER

By G. SHEARMAN PETERKIN, M. D., F. A. C. S., Seattle, Washington

FIFTY-THREE per cent of mortality in total extirpation of the bladder and 45 per cent in suprapubic resection, if the mortality following recurrence is included, are the statistics that confront the profession of medicine in operation by means of the knife on tumors of the urinary bladder. This being true, a vital question arises: How can the science of surgery reduce this appalling mortality?

At present the general surgical world does not recognize that surgically the bladder is often practically located in the peritoneal cavity, and this fact, combined with the anatomical structure and physiological functions of this organ, indicates rather than contra-indicates radical surgical methods.

It is the writer's opinion and experience that the principles of surgery of to-day as applied to malignant growths in other parts of the body—the breast, for example—are applicable to the bladder; and the answer to the question propounded is to be found in the maxim, ever to be borne in mind, "The more radical the operation the greater the percentage of cures."

The term radical as here used signifies opening the peritoneal cavity whenever by so doing it gives freer access to the pathological area, and cutting wide of the tumor to the extent of removing all the layers of the bladder wall, including the peritoneum, at least one inch beyond the area involved.

That this is not radical, and that it is the premises upon which the general principles of surgical technique must be constructed that will govern operations upon tumors of the bladder, the writer will attempt to prove, and in so doing will out-

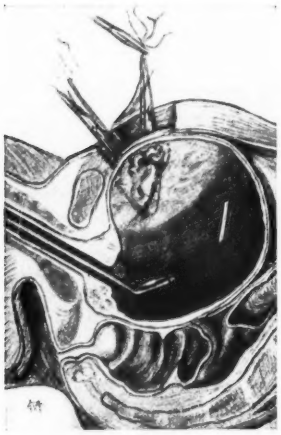

Fig. 1. After Hagner. Use of sutures to outline bladder tumor.

line the general principles of surgical technique which, if employed, will lessen the percentage of operative mortality and increase the percentage of cures over those now attained through operative treatment of bladder tumors.

The term non-radical is defined as suprapubic resection when opening the peritoneal cavity will give better access to the field of operation—the cutting out of some layers instead of wide excision of all layers of the bladder wall surrounding the tumor, operating through an operating cystoscope, a method as antiquated as Bottini's operation on the prostate.

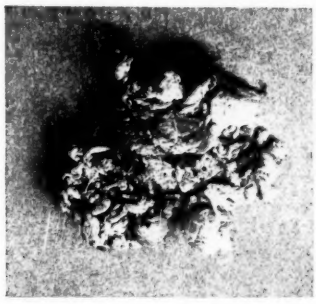

Fig. 3.

EVIDENCE THAT OPENING OF BLADDER VIA PERITONEAL CAVITY IS NOT DANGEROUS

(*a*) Laboratory experimentations upon animals by Barney, Tuffier, de Quervain, and others, have demonstrated that normal urine is not very irritating to the peritoneum, and the chances of infection are small.

(*b*) Reported clinical cases of rupture of the bladder with recovery after urine has escaped into peritoneal cavity (Alexander, Zuckerkandl, Keyes, and others).

(*c*) The transperitoneal method of operations on bladder growths as suggested by Rydygier in 1888, advocated by Harrington in 1893, and popularized by the Mayos in 1908, which method gives 9 per cent mortality as against 20 per cent by suprapubic resection (Watson).

(*d*) Demonstrations by Tennant, of Colorado, that transperitoneal cystostomy can be done even in presence of severe cystitis without danger.

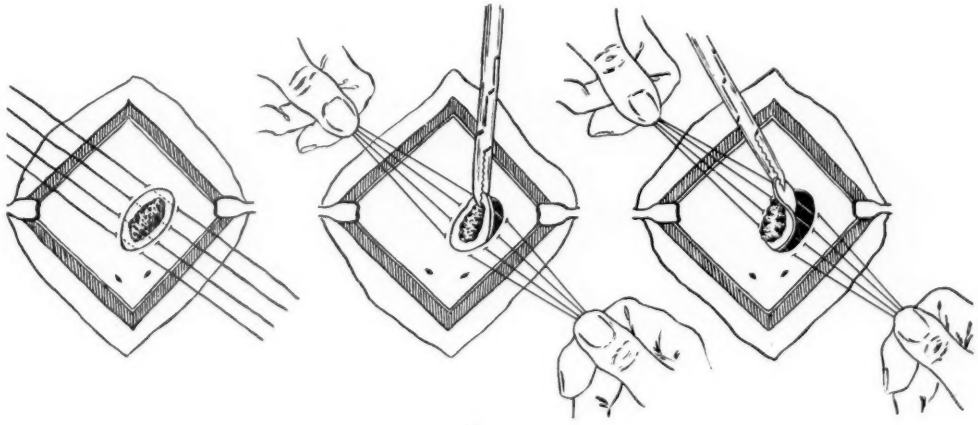

Fig. 2.

Fig. 4. Papilloma of bladder. Showing the complex character of the villi and very liberal blood supply.

Fig. 5. Papilloma of urinary bladder. Showing infiltration in carcinomatous degeneration: a, epithelium stratified columnar in type; b, small round cells, numerous in the papillæ; c, epithelial cells invading stroma of round cells; d, blood-vessels.

(*e*) An experience encountered by virtually every surgeon who has operated extensively—the accidental opening of the urinary bladder during operations, with no bad results.

Evidence that the anatomical structure and physiological functions of the bladder are such that free excision of its walls is not contra-indicated is furnished by cases reported by Harris of Chicago, Zuckerkandl, Rövsing, and others; also three cases by Kolischer and Schmidt, where more than two-thirds of the bladder wall was removed, the healed bladder having a capacity of 250 to 300 ccm. within eight weeks.

Unquestionably such evidence demonstrates that the anatomical locality, structure, and physiological functions of the bladder do not contra-indicate radical methods. Yet the question remains to be answered, why a cutting operation should virtually always be radical. The answer is self-evident.

1. No cystoscopist can tell by means of cystoscopy whether a tumor is benign or malignant.

2. No pathologist can tell whether any bladder tumor is benign or malignant unless he examines the whole tumor; to permit him to do this would necessitate a radical operation.

3. Hugh Cabot, E. Hurry Fenwick, Sir Henry Thompson, Watson, Kolischer, Israel, Cathelin, and most of the well-known urologists agree that clinically about one-half of all bladder tumors are malignant.

4. The same urologists believe that in the most frequent of all so-called benign tumors, the papilloma, there is a recurrence of almost 40 per cent after operation (Fenwick).

To reiterate, these facts exist: About one-half of the bladder tumors are malignant; 40 per cent of benign tumors recur after operation; the cystoscopist and pathologist have no means of making a preoperative diagnosis as to malignancy of tumors. Therefore, we are more logical and less radical in considering all tumors of the bladder malignant until our present methods of diagnosis are improved.

Moreover, that we can consider them malignant with less danger to the patient is demonstrated:

(1) By clinical experiments showing that in operations on the bladder, even if only a small portion of the bladder wall is left, this remaining portion has the power of development to the extent of almost regaining the total physiological bladder capacity; and (2) by the low mortality of the transperitoneal operation as against suprapubic resection.

With such a collection of facts, can the surgical world give any logical reasons why operations on the bladder should not be radical, as here defined?

In concluding this part of the argument, to show the value of radical versus the non-radical operations in obtaining a cure, let me again quote Watson, who in February, 1913, presented

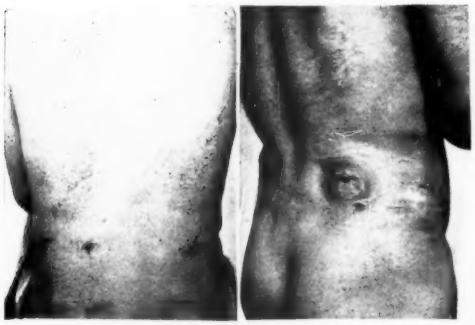

Fig. 6. Ureter openings before the apparatus is applied.
Fig. 7. Ureter openings after the apparatus is applied. Note the pouching of the ureter, especially the right projecting so that it has the appearance of an erect nipple; protruding thus causes the urine to drop in the cup, not to seep along the skin.

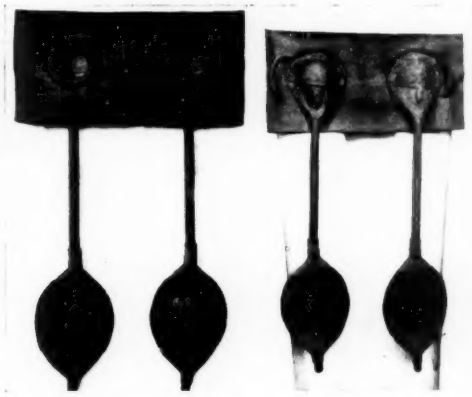

Fig. 8. Inside of apparatus. Entire apparatus composed of rubber.
Fig. 9. Exterior of apparatus.

statistics of 62 cases of real radical operations (total extirpation) with 33 deaths, 14 post-operative deaths, and 16 recoveries (and in all cases of death only two were attributed to recurrence), as against 103 cases of suprapubic resection, with 20 per cent deaths, 50 per cent recurrence, to be followed by 62 per cent mortality.

Comparing total extirpation with suprapubic resection, the latter presents a far greater percentage of recurrence, since if we review the histories of the non-radical operations we find most of them are virtually operations of election, not of necessity, as were the operations of total extirpation.

Being radical alone will not reduce the mortality, and such is not the claim of the writer for an instant. The essential subsidiary aids of correct surgical technique are equally as important. By accepting as a premise upon which to work the radical operation as here defined, then logically reviewing the causes of operative deaths, the means of preventing such deaths will become evident and can be classified so as to be of actual working value.

To demonstrate: Exclusive of faulty technique due to lack of asepsis, to lack of anatomical knowledge and to inexperience, the causes of death after operations on tumors of the urinary bladder are: (1) Shock; (2) ascending renal infection; (3) uræmia; (4) recurrence and metastasis.

The first cause of death, shock, is preventable through (1) early diagnosis; (2) shortening the duration of operation; (3) preventing hæmorrhage; and (4) proper preoperative preparation—the selection of cases, anæsthetist, and anæsthetic.

1. *Early diagnosis.* The clinical sign that permits of early diagnosis is hæmaturia, especially symptomless. Though this hæmaturia has the clinical characteristics of appearing without cause, being unaffected by rest, position, or exercise, nevertheless cystoscopy by an expert cystoscopist is imperative, for by no other means can the source of the hæmorrhage be located and the size, number, position, and possible characteristics of the tumor be ascertained.

2. *Shortening duration of operation.* This is attained (*a*) by formulating a definite plan of procedure previous to operation, through cystoscopically locating the exact position of tumor or tumors, outlining the amount of bladder wall to be removed, etc., and then perfecting a technique that will permit of readily marking out the area to be removed, whether the bladder is collapsed or not (Fig. 1, after F. R. Hagner).

(*b*) By increasing the size and clearness of the visual field by a long abdominal incision, by opening the peritoneum, by position of the patient, etc.

(*c*) By keeping field of operation dry when bladder is opened through catheterization of both ureters previous to operation, administering ether, or preferably chloroform, and placing the patient in the Trendelenburg position, as under these conditions anuria is produced and practically very little urine enters the bladder (Bovée).

(*d*) By catheterizing the ureter near which the tumor is located previous to operation, thereby clearly defining its outline and locality, so as to

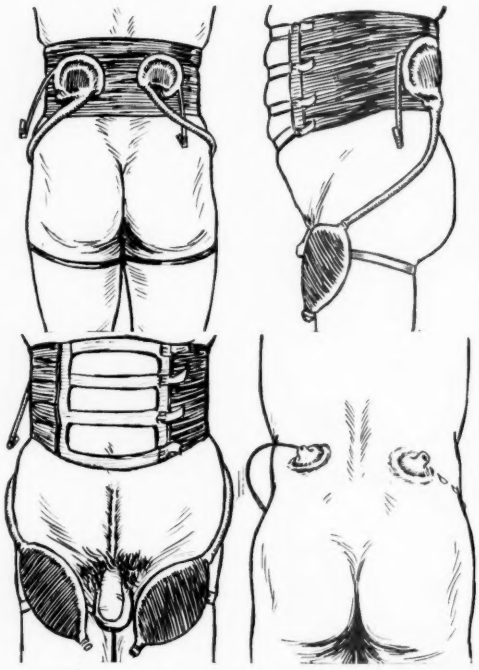

Fig. 10. Apparatus applied. Four and one-half inches from center, two inches from crest.

permit removing of bladder area near ureter without injury of same and the more ready transplantation of this canal if necessary.

(*e*) By permitting escape of contents of bladder through urethral catheter or cystoscope after marking out area to be removed, to prevent metastasis, wasted time in sponging, and postoperative shock through possible sepsis from contents of the bladder.

3. *Preventing hæmorrhage.* This is done by employing technique that will eliminate the direct handling of the tumor, as follows: Insert No. 2 catgut suture just beyond edge of healthy bladder wall to be excised, then under tumor (the finger in rectum or vagina if tumor is at base) to a similar point in bladder wall on opposite side. Now incise bladder wall (all layers) and grasp same with forceps as illustrated (Fig. 2); then, an assistant using these sutures and the surgeon the forceps as tractor, excise tumor.

4. *Proper preoperative preparation.* Time prohibits the consideration of these factors that would aid in preventing shock, yet the author personally recommends the use of spinal anæsthesia in bladder tumors whenever possible, and would refer the readers interested in this form of anæsthesia to the articles in the bibliography on this subject.

The second cause of death, ascending renal infection, is prevented (1) by transplanting the ureter in one of two places—the bladder or the lumbar region, for in both instances, should infection take place, it can be cured by local treatment, which cannot be done if the ureters are transplanted in any parts of the intestines or concealed part of the body; (2) by selecting the points of exit and maintaining direction of transplanted ureters so as to prevent back pressure (note Case 3).

The consideration of the third cause of death, uræmia, is omitted in this paper, as its pathological phenomena are within the province of the internist and cannot be prevented by surgical technique, as can shock, renal infection, and metastasis.

The fourth cause of death, recurrence and metastasis, are prevented (*a*) by early diagnosis; (*b*) by radical operation, as here advocated; (*c*) by no direct handling of tumor so as to break or destroy its continuity, especially a papilloma; (*d*) by walling off with abdominal pads the surrounding abdominal walls and tissues.

As a practical illustration of the value of radical operations on tumors of the bladder, I shall report three cases.

Case 1. Papilloma. Male patient, married, aged 46. Operated upon December 7, 1909; left hospital fully recovered, December 22; no evidence of recurrence; died June 9, 1913, three and a half years later, with no evidence of bladder involvement, but from chronic morphinism.

Symptoms. Profuse hæmaturia and retention due to villi blocking the mouth of bladder, prostate being normal. Growth was located one-half inch to right and one-fourth inch posterior to left ureteric orifice. Photograph of gross specimen (Fig. 3) shows tumor to be of characteristic villus type. Drawings from microscopic sections show: (Fig. 4) By the complex character of villi and their very liberal blood supply that the tumor is benign; (Fig. 5) By the infiltration and carcinomatous degeneration that the tumor is malignant, not benign.

Points of Interest

1. Only a small microscopic area showed the true character of tumor, that it was a commencing carcinoma, confirming the statements made as to the cystoscopist's and pathologist's ability to diagnose the benign or malignant character of bladder tumors.

2. All layers of the bladder wall were excised, and at a distance of three-fourths of an inch from the tumor, which probably accounts for its nonrecurrence.

3. The ureter was catheterized to facilitate

its removal and lessen the duration of the operation.

4. The tumor being situated at the base of the bladder, the value is shown of two fingers of an assistant inserted in the rectum to elevate the tumor so as to bring it into better view and shorten the operation. A proctoscope is sometimes more efficient.

5. The cut edges of the bladder wall were united only by interrupted catgut sutures, ten days chromicized. A suprapubic drain was inserted. Experience to-day would, in order to hasten recovery, cause the operator to close the bladder, catheterize every four hours if necessary, and not drain by permanent catheterization per urethra.

6. Never, if possible to avoid it, incise bladder, then excise tumor; by marking out the area to be removed previous to operation, make the only incision into the bladder the excised area, thereby materially aiding in preserving the bladder function, lessening the length of the operation, and hastening recovery.

7. A special point to be remembered, because of the rapidity and frequency with which papilloma recurs, is that cystoscopy should be performed every month for one year, every three months the second year, and every six months the third, in order to anticipate an early recurrence.

CASE 2. Male, age 42, referred by Dr. W. A. Shannon. Sarcoma; operated on May 17, 1910; June 12th patient left hospital; died May 19, 1911; cause, metastasis present in the form of two large sarcomatous masses on spine. Symptoms previous to operation, constant hæmaturia and painful urination when hæmorrhage was severe.

Points of Interest

Over one-half of the bladder wall was removed July 20, 1910; 63 days from the date of operation the bladder capacity was 310 ccm.; no recurrence of bladder symptoms at time of death, showing the power of a small portion of bladder wall to regain virtually the normal physiological capacity of the whole bladder when a large amount of bladder wall is removed.

As the tumor was situated on the right side of the bladder and involved the lateral superior and anterior surfaces, cutting wide of the tumor necessitated excising the bladder wall along the edge of the prostate for a distance of about one inch. Naturally the bladder wall could not be coapted at this point, so a triangular opening in the bladder remained, the base of the triangle being the prostate and the apex the united bladder wall. An incision through the abdominal wall over this opening was then made to the right of the original median abdominal incision, which was closed; a drainage tube was inserted in the second incision, and the wound treated as in suprapubic prostatectomy.

CASE 3. Male, married, age 41; referred by Dr. B. H. Foreman of Tacoma. Diagnosis, carcinoma of bladder. Symptoms: hæmaturia, tenesmus, and pain when bladder was overdistended by blood clots.

Treatment. Oudin current from December, 1910, to March, 1911; no improvement. March 19, 1912, chloroform anæsthesia; suprapubic incision; diagnosis, tumor inoperable except by total extirpation. March 25th, the patient consenting, the ureters were transplanted into lumbar region. April 3d, bladder extirpated.

Results. Recovery; weight at time of operation, 140 pounds; now 210 pounds; general health excellent.

PRACTICAL POINTS TAUGHT THE OPERATOR

1. The advantages of operating in two stages, ureterostomy first. The shortest period of time advisable between operations is two weeks, though the resisting power of the patient to operative shock will govern this factor.

2. The character of urinal should be determined before operation, measurements for same made, and point of exit of ureters determined, so that no muscular movement will render the ureteral cups inefficient.

3. The points of exit selected should be marked with nitrate of silver before sterilizing the field of operation.

4. Approximately the best area for ureter openings is three inches from spine of vertebræ and one inch above top of crest of ilium.

5. *Urinal.* Measurement of ureteral cups: outer diameter, 4½ inches, inner, 2 inches; circumference: outer, 13 inches, inner 6 inches. Theory of action: Inflation of the pneumatic tube causes a vacuum, which holds the cups so close to the skin as to prevent leakage of urine or any escape of odor of same, yet does not interfere with motion, as is demonstrated by the patient following his vocation of attendant in the acute mania ward at state insane asylum.

6. Technique of transplanting the ureters: Iliolumbar incision; to save time, strip the peritoneum to the pelvis of kidney, using the pelvis as a guide to the ureter; free the ureter from its bed as low down as possible. Puncture the muscles in a slanting direction, after the method advocated by Watson. Pull the ureter through, then with a finger in the incision ascertain the direction of the ureter; see that there is no kink or sharp curve that will produce back pressure. Confirm the position of the ureter by a flexible ureteral catheter. The ureters in this instance were stitched to the skin, but the operator would not advocate this method, later

experience causing him to prefer the method advocated by Rövsing—that of allowing the ureter to remain free, projecting beyond the external wound, the atrophied portion to be cut off after the ureter has become fixed.

7. An early diagnosis permitted the sexual function to be preserved, by leaving one and one-half inch of bladder wall on the right side. The right seminal vessel was dissected from the bladder; the prostate was left and covered with healthy bladder wall; the sexual functions of the patient are now normal.

8. The pelvis was well packed with strips of packing gauze to the extent of filling the space left by the bladder, so as to prevent intra-abdominal pressure from separating the edges of the excised peritoneum; moreover, permitting the area to granulate up the obliterated cavity caused by the extirpation of the bladder, thus preventing enteroptosis and its sequelæ.

There are many other points, some theoretical and others of practical interest, to be learned from the study of this case, but their value becomes evident only when presented in detail. They are, for instance:

1. The reason for selecting the opening for the ureters at points three inches from the spine and one inch above the crest.

2. The method of keeping the urinal clean, how it should be applied, the cost, etc., as viewed by patient and physician.

3. The explanation of the psychological fact that the patient always feels the sensation of urination when he empties his urinal. Is it due to the fact that the position of the urinal permits him to empty same by simply unbuttoning his trousers as he did before the operation?

4. The fact that one kidney (the right) secretes phosphates continuously so as to incrust the urinal; the left does not.

5. The left kidney (infected) was cleared by treating the pelvis as one would the bladder in cystitis—by irrigation with boracic acid and instillation of argyrol.

6. The report on the functional activity of the kidneys, which have been frequently tested.

7. The X-ray plates of the ureters, pelvis of kidney, and also the urethra.

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ON THE BLOCKING OF INFRA-ORBITAL AND MENTAL NERVES AT THEIR FORAMINA TO INDUCE OPERATIVE ANÆSTHESIA IN THEIR CUTANEOUS DISTRIBUTION

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WITH the advent of nerve-blocking appear papers that deal with the subject in general,[1] but few that detail the applied anatomical technique. I recently proposed[2] infiltration of the lingual nerve, both for temporary anæsthesia in operations in the anterior two-thirds of the tongue and for permanent relief of chronic pain, as in inoperable carcinoma. Also I proposed infiltration of the auriculotemporal nerve for operations upon the pinna and external auditory canal.[3] The following cases illustrate the title of this paper.

BLOCKING OF INFRA-ORBITAL NERVE

Case 1. C. F., male, white, aged 53, reported in the Surgical Out-Patient Department of the University Hospital, in the service of Dr. B. A. Thomas, August 15, 1913, presenting upon the lower half of the right side of the nose, just above the ala, an indolent epithelioma (rodent ulcer) of two years' duration. It was the size of a thumbnail, shallow, and covered with dried blood crusts, removal of which provoked no bleeding. It was decided to desiccate the ulcer with the high-frequency spark, and the problem of anæsthesia presented itself. On account of the denseness of the tissues in this situation, and on account of the lateral cartilage of the nose forming the floor of the ulcer, infiltration was not feasible. Being in the territory presided over by the nasal branch of the infra-orbital nerve, it occurred to the writer to block that nerve at its emergence from the infra-orbital canal. Accordingly, 2 ccm. of a 2 per cent solution of novocaine with adrenalin 1:3000 was prepared and drawn into a syringe, the needle of which sought the infra-orbital foramen 1 cm. below the lower margin of the orbit and midway between the canthi. The foramen was found without difficulty, paræsthesia obtained, and the nerve blocked. The external nasal branch of the ophthalmic nerve was then infiltrated at its emergence between the nasal bone and the lateral nasal cartilage. A thorough desiccation was applied without any pain.

Since the infra-orbital nerve supplies the upper teeth, it seems possible to infiltrate it in its canal for the relief of toothache and for the painless extraction of teeth. Accordingly, I injected this nerve with methylene blue in a cadaver, exposed the canal by removing the orbital contents, and found that the solution had stained the nerve as far back as the sphenomaxillary fossa. I have had no opportunity of trying this method out in practice, but mention it in the hope that it may prove useful.

BLOCKING OF THE MENTAL NERVE

Case 2. M. S., male, white, aged 52, insurance collector, was brought to me by Dr. C. M. Ewing of Philadelphia, presenting a superficial ulcer 1.8 cm. in diameter (the size of a dime) in the center of the lower lip, with its anterior border at the mucocutaneous junction. Duration, four years. Surface of ulcer dry and it did not bleed readily. Extended in depth to, but did not involve, the orbicularis oris. Submental lymph-nodes not palpable. Submaxillary enlarged on both sides to size of pea, but this was readily accounted for by the carious and tartared teeth, with their marginal gingivitis. It was planned to excise a piece for histological examination and, since the ulcer was so superficial and indolent, to desiccate the remainder with the high-frequency spark. The patient was nervous and desirous of avoiding pain, and requested that no needle be inserted near the ulcer. Accordingly, it was decided to block the mental nerve, and as the ulcer occupied the center of the border of the lip, it was patent that both sides must be anæsthetized.

A spot on the skin which lay before the mental foramen was iodinized and infiltrated intradermically with a drop of a solution of 2 per cent novocaine with adrenalin 1:3000. The hypodermic needle was withdrawn and a minute later reinserted perpendicular to the surface of the mandible to seek the mental foramen. The position of this foramen may best be understood by stating that in skiagrams of the mandible it can readily be mistaken for a focus of disease just below the roots of the second premolar tooth. More specifically, it interrupts the external oblique ridge at about midway between the alveolar and inferior borders of the mandible. Its direction is downward, forward, and inward. If the alveolus has been absorbed, due allowance must be made, for now the foramen lies close to the upper border of the mandible (basilar part). Its diameter is one sixteenth of an inch (1.5 mm.). A finger of one hand was placed in the buccal cavity and followed the second premolar until halted by the reflection of the mucous membrane. This was to insure against the needle entering the buccal cavity as an atrium of infection. Entrance of the needle into the foramen was signalized by its sudden drop and by paræsthesia of the nerve. One ccm. of the same solution was injected. The opposite side was similarly treated. Perfect anæsthesia in the distribution of both nerves was almost immediately obtained. A piece of ulcer was excised and the remainder desiccated with a long, deeply penetrating high-frequency spark without any pain whatsoever. A minute branch of the inferior coronary artery was cut, but the oozing was readily checked by pressure with cotton saturated with a strong solution of permanganate of potash mixed with adrenalin.

So perfect was the anæsthesia that I could readily have removed the ulcer radically and performed cheiloplasty, particularly since there was no patent metastatic carcinoma of the submental

[1] Harris. J. Am. M. Ass., 1913, lxi, 1040.
[2] Surg., Gynec. & Obst., 1913, xvii, 114.
[3] Boston M. & S. J., 1913, Oct. 2.

lymph-nodes to take me beyond the anæsthetized area. For the removal of these cervical lymph-nodes it is feasible to block the second cervical nerve at the middle of the posterior border of the sternomastoid muscle.

The dental branches to the incisor and canine teeth may be blocked through the mental foramen, and since both nerves supply six teeth, genuine painless dentistry would be realized for nearly one-fifth of all the teeth, and at least for the most sensitive ones. Toothache in any of the six may be readily relieved.

MANAGEMENT OF LABOR IN CASES WITH RELATIVELY CONTRACTED PELVES

By NEVIL M. GARRETT, M. D., Frankfort, Kentucky

A SUSPICION of pelvic deformity is aroused by smallness of a woman's stature, by a waddling gait, and by malformation of her limbs or spine; also, in the case of a primipara, by a pendulous abdomen and by the fœtal head not being fixed at the brim at the commencement of labor, and in a multipara, by a history of previous tedious and instrumental labors."

The presence of one or more of the above symptoms should not be taken as positive evidence that the pelvis is contracted, but when seen before the onset of labor, they do call for an investigation of the case, that an idea of the size of the pelvis may be formed.

I believe it to be good practice to make a digital examination of all obstetrical patients, at least a month before the expected confinement, even though the patient be a multipara who has borne several children without particular trouble. Such a patient may now have an abnormal growth in her pelvis, which will render delivery at term difficult or impossible. Such a growth may have been present at the time of the last delivery, and have been of such small size as to have caused no particular trouble, but since that time may have attained such size that we will be compelled to reckon with it.

In all primipara, and those multipara whose last labors have been particularly difficult, we should form an idea as to the size of the pelvis by the use of the pelvimeter.

The diameters of the most practical importance are the internal conjugate, external conjugate, interspinal, intercristal, transverse of outlet, and anteroposterior of outlet. A marked diminution in the interspinal and intercristal diameters leads to the suspicion of a transversely contracted pelvis. If the intercristal diameter is no greater than the interspinal, or if it is less, the pelvis is probably rachitic. A notable diminution in the external conjugate shows that we have to deal with a flattened pelvis. If the three principal external measurements are unusually short, but are in the normal proportion to each other, they indicate a generally contracted pelvis, which is the most common variety in the United States.

Inasmuch as the size of the pelvis constitutes only one factor in labor, a woman may give birth to one or more children at term without difficulty, and with another be the subject of a contracted pelvis, owing to the size of the child's head. We can form some idea as to the capacity of the pelvis but we have no accurate way of determining the size of the fœtal head.

The normal internal conjugate diameter, or conjugata vera, is four and three-eighths inches, and is the shortest distance between the anterior surface of the sacral promontory and the posterior surface of the symphysis. It is the available anteroposterior space at the inlet for the passage of the fœtus.

Unfortunately, we have no satisfactory method of measuring this diameter and usually rely on the measurements of the external conjugate or the diagonal conjugate, which is taken by measuring the distance from the sacral promontory to the lower margin of the symphysis and subtracting from five-eighths to three-fourths inches, according to the height and inclination of the symphysis. Any material shortening of the true conjugate constitutes a pelvic contraction.

In studying the treatment of this condition it is well to divide the contraction into the following degrees: That of major contraction, where the conjugata vera is below three inches; medium

contraction, where it is from three to three and three-fourths inches, and minor contraction, where it is from three and three-fourths inches to normal.

Statistics show that about 75 per cent of women with contracted pelves, where the contraction is not absolute, will have spontaneous deliveries, or at least be delivered without major surgical procedures. "Naturally, up to a certain point, spontaneous delivery gives the best results for mother and child. From that point, however, the prognosis becomes less favorable." Cases have been recorded of spontaneous birth through pelves whose internal conjugate diameters ranged as low as two and three-fourths or three inches, but such cases are rare. In flat pelves of three and one-half inches, and generally contracted ones of three and three-fourths inches, there is great probability of spontaneous delivery, but below these figures the chances become less as the size of the conjugate decreases.

In the major and minor degrees of contraction there is not so much room for discussion as to treatment, as the latter, if given sufficient time, will nearly all deliver themselves, some possibly requiring version or the use of forceps. Major cases at term, with viable children, practically all require cæsarean section. The cases allowing the greatest difference of opinion as to treatment are the moderately contracted ones, ranging from three to three and three-fourths inches.

The treatment of such cases varies with different individuals. The doctor who has had several cases, all of which have had spontaneous normal deliveries, naturally does not look upon a relatively contracted pelvis with the same degree of concern as does one who has lost a patient from rupture of the uterus in the same condition.

The principal methods of treatment are:

1. Premature labor at about the thirty-sixth week.

2. Test of labor at term, followed, if necessary, by forceps or version, and in the event of failure to deliver by forceps, this is followed by pubiotomy or cæsarean section.

In the event that version is unsuccessful, craniotomy will most likely be indicated, as the child usually dies unless delivery is rapidly completed when this method is employed.

3. Cæsarean section.

The author has sent the following questions to a number of obstetricians and surgeons:

Number of cases observed?

Where you have charge of the case primarily, what method of treatment do you prefer?

Do you consider the high forceps operation justifiable?

In cases that have been allowed to go to term and cannot be otherwise delivered, do you prefer cæsarean section or pubiotomy?

Which operation has the greater mortality?

What has been your experience as regards union of the bone after pubiotomy?

Fifteen of those addressed replied, but seven failed to supply suitable statistics. However, the remaining eight reported enough cases, including the small number observed by the writer, to make a series of 2,935 cases. The number of cases reported in most instances is approximate, as most of those replying were unable to give the exact number. I feel sure that many cases of absolute contraction were also included.

In reply to the question, "Where you have charge of the case primarily, what method of treatment do you prefer?" three prefer test of labor at or just before term; three prefer induction of labor at about the thirty-sixth week, while one prefers cæsarean section, unless spontaneous labor or low forceps is probable.

Practically all agree to the high forceps operation, under varying conditions, in expert hands. One says that it is never justifiable in first labors and one prefers version.

In reply to the question, "In cases that have been allowed to go to term and cannot be otherwise delivered, do you prefer cæsarean section or pubiotomy?" four, representing 305 cases, prefer cæsarean section, while four others, representing 2,625 cases, prefer pubiotomy, under certain circumstances.

Replying to question 5, five say that cæsarean section has the greater mortality, while two say that pubiotomy has.

Replying to the question, "What has been your experience as regards union of the bone after pubiotomy?" practically all of those who have had experience with the operation, are satisfied with this phase of it. One who opposes pubiotomy says that union is occasionally faulty. It appears that bony union is not essential. In fact, the majority have fibrous union, which may be an advantage in the event that the patient again becomes pregnant.

Just here I think it well to quote exactly the answers of some of those reporting the largest number of cases.

J. Whitridge Williams, who reports upwards of 2,000 cases, says:

"As over 75 per cent of all cases end spontaneously, my conduct in the relatively contracted pelvis is extremely conservative. If the conju-

gata vera is above 7.5 cm., I wait for a spontaneous outcome in primiparous women, unless the child is unduly large; while in multiparæ, I interfere primarily only when the history of past pregnancies indicates the probability of serious dystocia, or when the head is so large as to make it improbable that engagement would occur.

"If spontaneous labor does not occur after a reasonable test of the second stage, I believe that in such cases pubiotomy should be done, provided the mother and child are both in good condition at the time the operation is considered. Under these circumstances, I and my assistants have done between 50 and 60 consecutive pubiotomies without a death. My reason for preferring pubiotomy late in labor to cæsarean section, in the type of cases under consideration, is that the former has a mortality of only 1 or 2 per cent, whereas the latter has one of from 8 to 10 per cent. In my experience ideal results are obtained from the classical cæsarean section only when performed at an appointed time at the end of pregnancy or in the very first hours of labor; its mortality appearing to increase with every hour labor continues.

"In the great majority of my pubiotomies there has been fibrous instead of bony union. This I regard rather as an advantage, as in not a few cases it leads to permanent enlargement of the pelvis and obviates the necessity for interference in future pregnancies. All of my patients have been seen since operation and both they and I are pleased with its ultimate result.

"Do not misunderstand my advocacy of pubiotomy. I regard it as a makeshift operation to be undertaken in cases in which we have overestimated the powers of Nature or underestimated the size and consistency of the fœtal head. It is an operation to be undertaken only after a test of labor. If we feel sure in advance that interference will be necessary, cæsarean section done early is the proper treatment."

A. J. Rongy, reporting approximately 300 cases, in answering question 4, says:

"Depends whether or not the case is supposedly infected. This is determined, as far as possible, by the study of each individual case. The deciding factors usually are: The amount and character of manipulation the patient had, the competency of the physician or midwife, length of time in labor, general condition of patient, such as degree of exhaustion, the character of pulse and temperature.

"If the condition of the mother is such that abdominal section, and with it, the entrance into the peritoneal cavity, is considered an additional danger to the mother, cæsarean section is eliminated and pubiotomy then becomes the operation of choice."

J. Clifton Edgar, reporting "several hundred cases in twenty-five years," prefers "pubiotomy in funnel pelves and contracted outlet, and in most cases with engaged head."

Theodore J. Doederlein, reporting about 20 to 30 cases, says:

"I perform pubiotomy in secondary cases; i.e., cases that have gone through the hands of midwives, etc. Cæsarean section in primary; that is, clean cases."

Carey Culbertson, reporting about 275 cases, prefers cæsarean section. He says that "pubiotomy should be complementary to cæsarean section, and not an operation to take its place. The field of pubiotomy is strictly limited."

Treatment. The induction of premature labor, at or after the thirty-sixth week, has much to commend it in certain cases; namely, where the contraction ranges from three and one half to three and seven-eighths inches, and where the circumstances are such that the child will have proper care and nursing. The induction of premature labor — undertaken not before the thirty-sixth week, under the most rigid aseptic technique — should have practically no maternal mortality, and while most authors place the fœtal mortality high, if the method be followed only in cases with a true conjugate of not less than three and one-half inches, and done from two to four weeks before the expected termination of pregnancy, the fœtal and maternal mortality, considered jointly, should compare favorably with the other methods of delivery.

Podalic version has been employed in contracted pelves, but it gives a high fœtal mortality, and if good maternal results are to be obtained, the procedure has to be undertaken soon after rupture of the membranes, before we have given nature sufficient time to see if she can effect delivery with the head presenting; therefore, if version be generally employed in this condition, many cases would be subjected to it, with a resulting high fœtal mortality, which, if left to nature, might terminate spontaneously.

If the contraction is below three and one-fourth inches and has been allowed to proceed beyond the point where premature delivery might have been most indicated, then cæsarean section is the operation of choice, if seen early enough; that is, before or at the beginning of labor and before the patient becomes exhausted and probably infected. If the true conjugate is three and one-fourth inches or greater and the head can be made

to enter the pelvis, then the patient should be given a test of labor at, or before, term, using extreme care to prevent infection and allowing reasonable time for the head to mold. If, after a reasonable test of the second stage, the head cannot be made to engage, with the patient in the Walcher position, then a trial may be made with the forceps, but great care should be exercised in their application and use, and if no progress is made after two or three attempts they should be left in position and a pubiotomy performed, after which delivery may be completed with the forceps.

Pubiotomy should never be selected as the operation of choice where it is apparent, before labor, that major surgical interference will be indicated, but in those cases that have been allowed to have a test of labor and cannot be delivered by the reasonable use of forceps, it is indicated if the mother and child are both in good condition. It is especially indicated in those cases where the head is impacted low in the pelvis and where the outlet is contracted.

In the event that cæsarean section is undertaken upon a case which is supposedly infected at the time, it will probably be better to remove the uterus at the same time.

Craniotomy upon the living child, if ever justifiable, is so in exceptional circumstances only, but if the child is dead and the contraction is not below two and one-half inches, it is the method of choice, provided delivery cannot be easily affected by version or forceps.

The tendency at present is to regard craniotomy upon the living child as never justifiable. This is a point which each one must decide for himself, but looking at it from a purely human point of view, it probably is justifiable in sections remote from trained surgical help, where both mother and child will probably die unless something is done. However, such instances must be rare in this country.

Some authorities believe in craniotomy, where a markedly hydrocephalic head is the cause of dystocia, and also advocate inserting the instrument to the base of the brain, in order to be sure that the child may be dead when born.

In such cases it may be justifiable to make a puncture sufficient to allow the fluid to escape, but to me it seems absolutely unjustifiable to go further, unless the exigencies of the delivery require it. It is not our province to rid the family of an undesirable member at this stage any more than it would be after its advent into the world.

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TRANSACTIONS OF SOCIETIES

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD DECEMBER 19, 1913, WITH THE PRESIDENT, DR. FRANK W. LYNCH, IN THE CHAIR

DR. WILLIAM M. THOMPSON reported three cases as, follows:

CASE 1. Adenocarcinoma of the uterus. A woman aged 39, weighing 100 pounds, with a history of two miscarriages and three normal labors. Menstruation had been regular, and up to a year previously had lasted only one day. Four months before July 1, when she was first seen, she had been having intermittent hæmorrhages lasting about five weeks. For a period of the previous three months the hæmorrhage had been almost continuous. Physical examination showed an enteroptosis; the gynecological examination showed a pale, relaxed vagina and pelvic floor; the cervix was negative except for a stellate laceration; the uterus was the size of a six weeks' pregnancy at this and on three subsequent examinations. The cervix was hard and small; tubes and ovaries were negative; the body of the uterus was quite solid, and there could be felt in one corner a distinct mass. My diagnosis was between some retained decidua, although pregnancy was denied, and malignancy. I did a blunt curettement one day and a hysterectomy the next. The cervix was normal except for a bleeding vessel opening into the internal os, but up in the fundus was quite a mass, which presented a typical picture of adenocarcinoma of the fundus. The pathologist's report showed in the body of the uterus a fungating, bleeding, friable mass attached to the endometrium by a broad base. Sections through this mass showed no sharp line of demarcation between it and the tissue forming the muscular walls of the uterus.

CASE 2. A case of carcinoma of the intestine with chronic obstruction in a young girl aged 23, with no significant past or family history. Two weeks previous to being seen she had severe, sharp, intermittent pain in the stomach, with diarrhœa. Her physician had made a diagnosis of retroversion and put in a tampon. The pain continued, and the following day the menstruation came on; the pains were described as lancinating, extending clear up through the abdomen. She had had diarrhœa for a month, and at no time had a formed stool. Examination showed a tumor in the right iliac fossa extending up to the splenic flexure and across the abdomen above the umbilicus. This was a fœtal impaction. The uterus presented about an inch above the symphysis and was displaced forward. There was a bulging of Douglas' pouch. A median incision was made and a tumor extending throughout the whole length of the pelvic sigmoid was found. The tumor lay behind the uterus. There were no adhesions, but some metastases in the peritoneum. The mesentery was so long that it was easily possible to raise the tumor through the abdominal wall. The method used was to excise the tumor three inches above the mass and about three inches below and amputate the mesosigmoid. Into the upper end of the bowel a rubber tube 1¼ inches in diameter was passed and fastened with a purse-string suture, one stitch going through the tube. The other end of the tube was passed through the distal end of the bowel and out through the sphincter, and thus the upper end was invaginated into the lower and united by interrupted sutures. The sphincter was dilated. About six inches above the resection a lumbar colostomy was performed by the two-step method. On the second day the colostomy was opened with the cautery, a large catheter was passed into the transverse colon and warm olive oil injected, for four days. At the end of four days the woman had an enormous bowel movement, weighing about five pounds. The colostomy gradually closed.

The pathological report was as follows: Chronic obstruction; carcinoma of the sigmoid flexure; ulceration, the edges of the ulcer being composed of connective tissue, with which are found very small masses of epithelial cells. The masses extend in the submucosa far underneath the normal mucosa, and in many places the degeneration left large masses of mucus with a few pale nuclei here and there. Carcinoma of the sigmoid.

CASE 3. A large, vigorous woman weighing, in July, 1912, 190 pounds; 35 years of age; a widow with no children. Menstrual history was regular until two months before the time of consultation, during which she had flowed two weeks and stopped, had begun again, and was flowing at the time of consultation. She had four sisters, all of whom had been operated on for pelvic disease, but none with infection. They had either fibroid tumors or ovarian tumors and procidentia. The woman complained of prolapse of the womb. The abdomen was large; there was fluid in the flanks, and a large tumor reaching half way between the umbilicus and the ensiform. The tumor had the consistency of a cystic myoma — more solid than otherwise. The cervix presented at the vulva.

She was operated on July 18, and the tumor removed, with the ascites. The tumor was called in the operating room a pseudomucinous cyst of the left ovary. It was attached to the omentum at its lowest point and the omentum was excised two or three inches above the attachment. The woman did well for a year, and then she reappeared. The pathologic report showed a cyst having a capacity of about 500 ccm., with many small cysts in the wall extending into the cavity. The cysts contained substances of varying character — the largest of a thin, clear character, a smaller one of a mucoid character, and one of a thick caseous material containing hairs. The microscopic preparations showed papillomatous cystadenoma with epithelium, hair, and adipose tissue. The upper part was a pseudomucinous cyst; the lower part was a solid cyst and contained dermoid material.

The second time I saw the patient she had an enormous abdomen with a great deal of ascites and complained of a return of the prolapse. I opened the abdomen and there appeared to be a carcinomatous mass in the omentum. At the same time epithelial papillæ were dotted all over the

parietal and visceral peritoneum, and masses of papilla floating in the fluid. The abdomen was closed after removing the omentum almost entirely, leaving a portion in the region of the splenic flexure, and fixing the uterus to the abdominal wall. The woman was put back to bed and given over to X-ray treatment for a while. That was the last of June. The pathologist's report was that the specimen consisted of a tumor mass about the size of a hen's egg embedded in a mass of omental fat covered with smooth, shining peritoneum. The cut-surface shows a fatty tissue striated with grayish white fibrous tissue.

Histologically this section consists of an areolar fatty tissue containing within it trabeculæ of connective tissue of a cellular type in some places almost resembling spindle-celled sarcoma. Within this convertive tissue, which varies greatly in amount in various places, are found epithelial masses in the form of acini of exceedingly variable shape and size, in some places lined with multiple layers of epithelium of cuboidal type — metastatic carcimona of the omentum.

The next time she appeared, in April, the X-ray man found the tumor mass in one side had been reduced. I advised against operation. In October she returned with a urethral caruncle, ascites, and umbilical hernia. The caruncle was removed and the woman put to bed. This specimen was large like a polyp. It consisted largely of granulation tissue in which there was found a mass of squamous epithelium, irregular in outline, the tissue cells containing many mitoses. Urethral caruncle; carcinoma (?).

At the next operation, in January, the right ovary was removed, which at first operation was normal. It was found to be carcinomatous, about the size of a large orange. The carcinoma in the splenic flexure was smaller, and the small papillæ of the peritoneum were also smaller and were hard instead of soft.

This woman undoubtedly had carcinoma in the first cyst, that had been overlooked. It is a matter of common knowledge that the majority of cystic ovarian teratomata are innocent tumors, while on the other hand solid ovarian teratomata are of intense malignancy, invading surrounding structures and giving rise to metastatic deposits. Up to 1912 there had been nineteen similar cases reported.

Dr. N. S. Heaney reported the case of birth of a monster in a woman aged 33, who had always been extremely healthy, and was pregnant for the first time after six years of married life. The husband had a living healthy child 12 years old, from a previous marriage. The patient felt unusually well during pregnancy until the twenty-eighth week. The uterus had corresponded in height with the period of amenorrhœa until the twenty-eighth week, when there was a rapid increase in size, associated with marked pain. Heart sounds of one fœtus only were found. Because of the frequent association of twins and fœtal anomalies with hydramnios, an X-ray was taken by Dr. Potter. The picture showed one fœtus, which was very small for the thirtieth week. The vertebræ and femurs were plain, but no cranium showed. The patient, two days after the examination, suddenly had a gush of water and delivered herself within twenty minutes. (The product of conception was exhibited.)

Examination of the female fœtus shows a multiplicity of abnormalities: It is an exencephalus; the brain lies entirely free, the cranial vault being absent; only one eye is present, the brain protruding through the other orbit; the nose is only a little bud; the cord is adherent to the brain membranes; the left arm is adherent to the neck of the fœtus; the right arm is short and markedly deformed; the heart, liver, intestines, spleen, in fact, most of the abdominal organs lie outside of the abdominal cavity; also there is double club-foot. It was born dead.

Dr. Eugene Cary, in discussing Dr. Heaney's case, asked whether the chorion and amnion were attached. Dr. Heaney said that as far as could be made out macroscopically they were attached. The amnion could not be separated from the chorion in the parts examined.

Dr. Cary said he had asked the question because, on the head of the fœtus where the cord is attached to the brain and on the side of the neck where the arm which shows the greatest deformity was attached, there seemed to be a kind of membranous band. It is interesting to note that in several cases with malformations of the fœtus which have been reported by Stechel, who has collected 12 cases, the amnion was ruptured and there were found a number of adhesions of the amnion to the fœtus; and he and others believe that that is caused by the adhesion of the amnion, and in this case that may explain these abnormalities. Dr. Heaney's case is also of interest because there have been only three or four cases in which abnormalities of the fœtus associated with hydramnios were found. He had a case to report also in which hydramnios was responsible for the condition, but there were no malformations; but in the case reported by Ahlfield, hydramnios was responsible for club-foot, and in two or three other cases hydramnios caused some malformation, but in none of them were any adhesions found.

Dr. Heaney: The chronic hydramnios of the last weeks of pregnancy is not associated with a high percentage of fœtal abnormalities, while the so-called acute hydramnios of the earlier months is so frequently associated with abnormalities of some sort — hydrocephalus, spina bifida, anencephalus, exencephalus, and deformities of the upper part of the central nervous system — that it is inadvisable to make especial attempts to prolong pregnancy. The earlier the hydramnios occurs the more frequent and greater the percentage of fœtal anomalies.

Dr. Reed: I should like to ask Dr. Carey if some recent development in histology has discovered the covering of the cord to be amniotic. My idea was that there was no amniotic covering of the cord.

Dr. Cary: Not that I know of. I had in mind where the amnion reflected up on the cord from the placenta.

DR. ARTHUR H. CURTIS read a paper on "Bacteriology of Leucorrhœa" (see p. 299), and exhibited microphotographs and microscopic slides of the bacteria found in leucorrhœa.

DR. T. J. WATKINS: My ideas have changed materially in regard to this subject since Dr. Curtis has been making these examinations. It has been a source of surprise to find how few of these patients had any discharge from the uterus. The majority had a discharge of clear mucus from the cervix, occasionally a thick yellow plug.

The study in regard to the reactions of the discharge would seem to show that what has been written in regard to the vaginal and uterine cases is chiefly imaginative. Practically nothing of any interest has been found in the discharge relative to reaction. They are practically all acid, some rather weakly acid or nearly neutral.

It would also seem that much that has been said in regard to the relation between the general elimination, anæmia, and vaginal leucorrhœa is a matter of guess-work rather than of accurate observation. Many of these patients are in good physical condition, with good elimination, and attention to the eliminative organs has had practically no effect on the leucorrhœa.

The question of diagnosis is interesting. I find that heretofore I have been considering many of these cases gonorrhœal which were not. We were fortunate in having a number of cases in which there had been no gonorrhœal infection (in all these cases we have had conferences with the husband), and I know in some of these cases the husband has had no gonorrhœa, and there has been no suspicion that the wife had gonorrhœa; and yet these cases, diagnosed according to the superficial methods of examination heretofore used, would be pronounced gonorrhœal cases. In the diagnosis we have had no cases in which the examination of Skene's ducts has been of much service. In only a small number was a discharge found in Skene's ducts, and we occasionally found gonococci in these. It is difficult to determine what is a normal Skene's duct and what is an infected duct. These investigations also show that an examination microscopically of the discharge, to see whether the gonococci have disappeared, is of no use, because the gonococci disappear in all cases, irrespective of treatment.

DR. C. S. BACON wished to ask Dr. Curtis whether all these examinations had been made on non-pregnant women or whether some of them included leucorrhœa in pregnant women; and also whether he had attempted to classify the discharges according to their physical characters into more or less liquid or fluid discharges and thick, cheesy discharges, and if so whether the flora differ in the different kinds of discharges.

DR. HEANEY wanted to ask whether this had been a study of the vaginal secretions, or a study of cases of leucorrhœa, or did Dr. Curtis distinguish between cases of leucorrhœa and excessive vaginal secretion. Is it required that a smear have a leucocytic content in order to call it leucorrhœa, or does the intensity of the secretion, if otherwise normal in character, constitute a leucorrhœa? For instance, we may find in chlorotic young girls a secretion intense enough to stain the clothes, but which does not contain leucocytes or other apparent abnormalities. Dr. Heaney was surprised at the few cases in which Dr. Curtis found a visible purulent discharge from the cervix microscopically showing leucocytes. Where does the vaginal secretion come from? Is it mucus from the cervix that is altered in the vagina by organisms, or is it an exudate from the vaginal walls?

DR. GOLDSPOHN said he had held the thought expressed by the last speaker, that we need to recognize a more or less physiologic discharge that is not at all the result of infection; and if they are copious they may become impregnated with certain bacilli, such as the Döderlein, as a physiological or normal condition. Many women and young girls have what is called a catarrhal condition, a rather excessive vaginal and cervical secretion, perhaps intra-uterine. If there is no such thing as an intra-uterine discharge, he should be glad to learn that fact. But he would like to know whether there is not such a thing as a physiologic discharge that may become excessive under certain conditions, as pelvic hyperæmia induced by sedentary employment, by insufficient menstrual discharge, by sexual excitement, or by displacements. He had repeatedly seen a leucorrhœa stopped by righting a retroverted uterus. In regard to the gonococcus, that prepares the way for many affections, chiefly among those who have been pregnant. Whether it is the right thing to teach that as long as we can find the gonococcus under the microscope we should not interfere with nature's processes, and after it is no longer recognizable by the microscope we should institute our surgical relief, is a question.

DR. ROBERT T. GILLMORE said in regard to treatment, which Dr. Curtis had just touched in regard to bacterin therapy, we all know of the treatment by silver salts and the persistency of these leucorrhœal discharges, and how useless it is to give douches; he would like to know where

Dr. Curtis obtained his autogenous material, and also whether he has had any results with the Bulgarian bacillus in these cases.

Dr. Curtis, in closing, said it was difficult to classify all these infections according to whether the woman is pregnant, whether she had gonorrhœal infection, whether it was a mucous discharge, a purulent discharge, or no discharge. He had studied only 85 cases, and had hoped merely to open the way to a study of the trouble from which something of practical value might be developed. A small amount of discharge exists in every woman, whether married or not; this consists of a small amount of transudate and epithelial cells, together with the Döderlein bacillus, which is normal. As soon as there is a mucous discharge there is a pathological condition. His subject was chronic leucorrhœal conditions, which he attempted to limit to purulent discharges which contained leucocytes. He did not discuss cases in which there was a discharge from the cervix due to hypertrophy, erosion, or eversion. Mucus makes an excellent culture medium. A woman with such a discharge has an increase of the normal Döderlein bacilli, with complications depending on the amount of discharge and the amount of accompanying inflammation, extending through all gradations up to a profuse purulent discharge which is characteristic of marked cases of leucorrhœa. He had not formed any opinion about women who are pregnant. The cheesy discharges come from virgins, and usually contain the Döderlein bacillus only. Leucocytes are unusual. During menstruation, the only difference is that there is an increase in the culture medium and a temporary increase in the organisms. Examination of the mucus plug in the cervix for leucocytes gives little information of value, because of the tendency to contamination from pus-covered adjacent vaginal walls.

With Dr. Gillmore's permission, it seemed best to postpone all discussion of treatment until it can be taken up in detail.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

Principles of Surgery. By W. A. Bryan, A. M., M. D. Price, $4.00 net. Philadelphia and London: W. B. Saunders Company, 1913.

An Introduction to the History of Medicine. By Fielding H. Garrison, A. B., M. D. Price, Cloth, $6.00. Philadelphia and London: W. B. Saunders, 1914.

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Precis de Radiologie Pratique. By André Lomon and Camille Hahn. Paris: Société d'Editions Scientifiques et Médicales, F. Gittler, Directeur, 1913.

The Human Body and Its Enemies. A Textbook of Physiology, Hygiene, and Sanitation. By Carl Hartman, B. A., M. A., and Lewis Bradley Bibb, B. A., M. D. Price, 65 cents. Yonkers-on-Hudson, New York: World Book Company, 1913.

Report of the Proceedings of the English-Speaking Conference on Infant Mortality. Price, 3s. net. London: National Association for the Prevention of Infant Mortality and for the Welfare of Infancy, 1913.

First Book of Health. By Carl Hartman, B. A., M. A., and Lewis Bradley Bibb, B. A., M. D. Price, 65 cents. Yonkers-on-Hudson, New York: World Book Co.

The Principles and Practice of Gynecology. By E. C. Dudley, A. M., M. D. Price, $5.00 net. Philadelphia and New York: Lea & Febiger, 1913.

On Diseases of the Rectum and Anus. Including the Sixth Edition of the Jacksonian Prize Essay on Cancer. Fourth Edition. By Harrison Cripps. F.R.C.S. Price, $3.25. New York: The Macmillan Company, 1914.

Diseases of Women Medical and Surgical Gynecology. By Charles A. L. Reed, A. M., F. C. S., M. D. New York and London: D. Appleton and Company, 1913.

A Treatise on the Diseases of Women. For Students and Practitioners. By Palmer Findley, B. S., M. D. Price, Cloth, $6.00, net. Philadelphia and New York: Lea & Febiger, 1913.

Surgery of the Upper Abdomen. By John B. Deaver, M. D., Sc. D., LL. D., and Astley Paston Cooper Ashhurst, A. B., M. D. Price, $5.00. Philadelphia: P. Blakiston's Son & Company, 1913.

Tumors of Abdominal Viscera. By Professor Rudolph Schmidt and Joseph Burke, Sc. D., M. D. Price, $4.00. New York: Rebman Company.

Surgery of the Vascular System. By Bertram M. Bernheim, A. B., M. D. Philadelphia and London: J. B. Lippincott.

Genito-Urinary Diseases and Syphilis. By Edgar C. Ballenger, M. D. Price, $5.00. Atlanta, Ga.: E. W. Allen & Co.

The Stomach and Œsophagus. By Alfred E. Barclay, M. A., M. D., B. C., M.R.C.S. London: Sherratt & Hughes.

The Surgical Clinics of John B. Murphy, M. D. Philadelphia and London: W. B. Saunders Company.

BOOK REVIEWS

THE SURGERY OF THE STOMACH. Herbert J. Patterson, M. D. New York City: Wm. Wood & Co.

A review of this work of Patterson's has been one of the pleasures that seldom comes to those who make a discriminating study of books for the subject of review.

It is seldom that one finds a subject so clearly and concisely set down as is here done. There is little or no extraneous matter, the author discusses the work from a broad standpoint, yet at no place is there suggestion of verbosity. It was prepared for the printer too early for a comprehensive discussion of the use of the X-ray in the diagnosis of obscure lesions, but otherwise the student will find a complete résumé of the diagnosis and treatment of the various lesions, of the stomach.

Of especial interest is his discussion of anterior gastrojejunostomy, which has to a certain extent fallen into disrepute in the United States. His able defense of this procedure will serve to stimulate us to further investigation. One concurs with him in the advocacy of the wide incision in every case in which the stomach is to be operated upon, for the sake of careful examination of the entire abdominal viscera.

The author is not an advocate of the various types of gastropexy in gastroptosis, and one would like to have had a more extensive discussion of the subject than the author sees fit to give. As is natural, the larger portion of the book deals with the subject of gastric and duodenal ulcers with their complications. The value of this has been much enhanced by the extensive bibliography accompanying the various chapters.

In the after-treatment the early feeding of the patient by mouth is urged and severe condemnation given to rectal feeding.

One reads with pleasure the chapters on duodenal and gastroduodenal ulcer in which the author, because of his careful observations and study of these cases, is particularly competent to speak.

The chapter on infantile pyloric stenosis gives the English rather than the American view of this condition in that he advises conservatism with operation as a last resort. The good results obtained by American surgeons in this class of cases leaves no doubt in our minds that surgical intervention should be the proper procedure. The large series of cases by our own Scudder and Richter seem to have proven this.

It is a pleasure to recommend this volume to every surgeon. It should be in the hands of every one who wishes to keep abreast of the best thought in gastric surgery.

PRECIS D'ANESTHESIE LOCALE. Préface de M. le Prof. Reclus. By A. Piquand, Ancien chef de Clinique à L'hôtel-Dieu de Paris. Société d'Editions Scientifiques et Médicales.

This volume, designed for practitioners and students, is clear and precise, and while essentially technical is thoroughly comprehensible and advocates local anæsthesia for many operations which previously have not been attempted except under a general anæsthetic.

The first three chapters deal with indications and contra-indications for local anæsthesia, anæsthetic agents, and their chemistry. Technique in general is fully discussed in subsequent chapters, also the special technique employed in the various regions of the body, these being amply illustrated.

This book will be welcomed, not only by the student of local anæsthesia but by the surgeon who, not having mastered the technique, is prone to belittle the possibilities of local anæsthesia and employ a general anæsthesia many times to the detriment of the patient. H. A. POTTS.

SYPHILIS AND THE NERVOUS SYSTEM. By Max Nonne, M. D., Hamburg, Eppendorf. Translated by Charles R. Ball, B. A., M. D. Philadelphia: J. B. Lippincott Co.

The second edition of Nonne's text "Syphilis and the Nervous System" is an up-to-date review of the latest investigations on this interesting subject. However, there is no question but what this text has lost in value from the mere fact that it is a second edition. The former book was written prior to the discovery of the Wassermann reaction, and also prior to Ehrlich's work on "The Chemo-Bacterio-Tropic Therapy." These two important discoveries would of necessity require a complete new text on the therapy and diagnosis of syphilis of the nervous system, and Nonne has only revised his text on these matters. However, it is splendidly written. The inductive method of arranging the work is particularly attractive. The chapter on the pathology of syphilis could scarcely be improved upon. The chapter wherein the arguments for and against the theory that tabes can only be produced by syphilis is one which is a revelation to the average practitioner.

Nonne has also taken up the discussion of hereditary syphilis, behavior of the Wassermann reaction, prophylaxis, salvarsan therapy, the relationship of dementia paralytica to syphilis, and has given us splendid work on each of these subjects. His text is splendidly illustrated throughout, especially that part relating to the pathology of nervous syphilis.

TREATMENT AFTER OPERATION. By William Turner, M. S., F. R. C. S., and E. Rock Carling, B. S., F. R. C. S. London: University London Press, 1912.

This rather brief work is intended for the general practitioner and the house surgeon. The authors place before you in a brief way certain principles regarding the care of a patient following a surgical operation. They make no pretense to methods employed by other men, but quote only their own experiences.

Practically every subject is dwelt upon, although some of them in a very inadequate way, leaving much to the imagination of the reader.

In discussing abdominal surgery, the chapters begin with an enumeration of the various operations; following this each one is taken briefly into consideration, outlining the ordinary care and the possible complications that might arise and how they should be dealt with.

The later part of the work consists of a rather detailed chapter on the eye by L. V. Cargill, F.R.C.S. This chapter takes up much more detail than the preceding chapters, minutely giving technique and dressings. This gives the work a peculiar unbalance which is displeasing to the reader. J. A. WOLFER.

DISEASES OF THE RECTUM AND PELVIC COLON. Martin L. Bodkin, M. D. New York City: E. B. Treat & Co.

The author has handled the subject in a thorough, practical, and inductive method. We are first given an anatomical and physiological description of the rectum and surrounding structures, which is indeed very necessary to a thorough understanding of the pathological changes in this organ.

Next the general examination, general diagnosis, and general symptoms are consecutively taken up. Malformations, catarrhal diseases, sigmoiditis, proctitis, and the many other pathological changes, are discussed. Following this, the special operations are given, together with such consideration of medical treatment as its importance merits. There is a special chapter discussing the relationship of rectal diseases to gynecology, which is of interest and value. It is impossible to review in detail in the small space allotted the many valuable features of this work. It must be sufficient to say that it is complete, not so voluminous as to be cumbersome, and very clearly and intelligently written.

TUBERCULIN IN DIAGNOSIS AND TREATMENT. F. M. Pottenger, A. M., M. D., LL. D. St. Louis: C. V. Mosby Company.

Dr. Pottenger has devoted this little volume to the defense of tuberculin. The discussion which has continued since its memorable incipiency by Robert Koch is still continued. Pottenger makes you feel that he would like to discontinue it and come out as an enthusiastic champion of tuberculin, yet in every chapter he gives way to doubts and discussion, often inserting contradictory statements by other well-known authors. However, the text is, as its name implies, devoted to a consideration of the value of tuberculin in diagnosis and treatment, and as such mirrors wide exeprience and painstaking care. It is well written in language and argument that is easily understood. The author tells us to be circumspect and not accept negative tuberculin tests in face of other positive clinical findings. We are informed very intelligently as to the classes of cases suitable for tuberculin treatment and cautioned in every case to make use of all other therapeutic measures which are known to be of value.

The technique of administration, dosage, choice of preparation, method of dilution and preparation occupy at least one-third of the book and form an excellent working guide for the clinician who administers this much discussed and abused remedy.

COLLECTED PAPERS BY THE STAFF OF ST. MARY'S HOSPITAL, MAYO CLINIC. Contributions by twenty-three different surgeons. Philadelphia: W. B. Saunders Company, 1913.

The student of surgery in the future will refer with great frequency to the various classes of surgical papers that have emanated from the Mayo Clinic. The present volume contains some of the most valuable contributions that have been published by the Mayo Clinic in the last few years. The ripened surgical experience of the Mayos has been supplemented in these volumes by many articles dealing with questions of surgical practice. They have fortunately turned their attention to clearing up some of the moot questions by extensive study of their cases as exemplified by the articles of MacCarty and others.

It is seldom that one can say, as may be said here, that every article in the volume is of pre-eminent importance, since there is no chaff but all wheat. We wish to congratulate the Mayos, not alone because of the great work they are doing in their clinics but because of their careful method of history taking and examination, which have made possible the presentation to the public of the experience they have gained at the operating table.

CHEYNE & BURGHARD'S SURGICAL TREATMENT, VOLUME V. By Sir W. Watson Cheyne, Bart., C. B., D. Sc., LL. D., F. R. C. S., F. R. S., and F. F. Burghard, M. S., F. R. C. S. Philadelphia and New York: Lea & Febiger.

The last volume of this series by Cheyne and Burghard includes the treatment of the surgical affections of the pancreas, liver and spleen, the neck, larynx, breast, and thorax, and the genito-urinary organs, including the kidneys.

It is a work intended to meet the demands of the practitioner rather than the student. Only enough space is devoted to the symptoms and pathology to render more intelligible the principles upon which the treatment is based and the various stages of the disease to which each particular method is applicable.

There is a tendency throughout this text to indicate and discuss at length only one method of treatment, although other methods are frequently mentioned. This innovation of relieving the practitioner of the burden of reading discussion of many different methods of accomplishing the same result should be appreciated, for it is indeed rare among the compilers of systems of surgery.

The illustrations are simple but useful, and it is to be regretted that many important points are left without illustrations where the use of them would greatly assist the reader to a more complete conception of the text.

The book, intended for the guidance of the practitioner, is very complete in detail with the possible exception of the portion devoted to after-treatment. This is one of the most important steps of surgery and it should be discussed clearly, simply, but fully, since upon the after-treatment depends to a large degree the successful termination of operation.

PYE'S SURGICAL HANDICRAFT. Edited and rewritten by W. H. Clayton-Greene, B. A., M. B., B. C., F. R. C. S. New York: E. B. Treat & Co.

There has been much added to this most excellent work, bringing it fairly well up to date. The subject of syphilis has been elaborated to include the technique of the Wassermann reaction and the salvarsan treatment.

It is indeed difficult to select any one part as the best. As the name of this work implies, it deals in those very important details of surgery which require some ingenuity and acquired skill. Many minor points which are so essential to the young surgeon are discussed in such a logical and concise manner that it becomes a pleasure to read it.

The subject of splints and various appliances for the treatment of fractures and sprains is clearly outlined and illustrated, and is well worth any surgeon's time to read.

The various minor surgical topics which confront the house surgeon, such as ulcers, frostbite, burns, abscesses, sprains and the various urinary disturbances and the like, form a chief part of the scheme of this book. It is so common in the ordinary texts of surgery to find these very important subjects briefly and inefficiently discussed that it gives this work a distinct position in the surgical literature.

Those diseases which require long and persistent treatment, with at times special appliances, such as vertebral caries, and tuberculosis of joints in general, are given a rather prominent place. The eye, ear, nose, and throat are also discussed in a very pleasing and efficient manner. The teeth, regarding which the surgeon knows so little, are also included. The treatment of different forms of poisoning, drowning, and other forms of suffocation are also given due consideration. The formulæ for enemata and various fementations are taken up in a logical manner.

After a careful reading of the book one must truthfully say that it fills a quite unique place in the library of the surgeon and an indispensable place in the hands of the student, the young practitioners, and the house surgeon. J. A. WOLFER.

DISEASES OF THE STOMACH. George Roe Lockwood, M.D. Philadelphia and New York: Lea & Febiger.

The author states that it is his intention to describe the diseases of the stomach as he has seen them and to present them from the standpoint of personal experience, and for this purpose he has grouped series of cases and analyzed them. He has faithfully carried out his purpose. The volume as presented is a most valuable one to the student and gastric surgeon. It is much more comprehensive than the ordinary text-book that one would expect to find as the result of personal experience, since it is a volume of over six hundred closely printed pages. This has given the author a chance to discuss each of the various symptoms, signs, and conditions in detail at great length, and consequently the volume will be found of special value to the beginner in this special field of surgery, although it can be read with profit by anyone.

Because of its extensive discussion it should be considered a book rather than a monograph. The student will find it a means of ready reference in the various conditions confronting him.

GYNECOLOGICAL OPERATIONS, INCLUDING NON-OPERATIVE TREATMENT AND MINOR GYNECOLOGY. Henri Hartmann, M. D. Translated from the French by Douglass W. Sibbold, M. D. Philadelphia: P. Blakiston's Sons & Co.

In the preparation of this work, the author has endeavored to give a complete exposition of the diverse methods of treatment employed in gynecology. Non-operative treatment is fully considered, as there is a general return to this branch of therapeutics. For this reason, much space has been devoted to minor gynecology, mineral water cures, kines therapy, and electrotherapy. Special attention has been given to procedures of choice and to the large number of figures and diagrams, in an endeavor to clearly illustrate each stage of the various operations. Throughout the whole text the author has shown painstaking exactitude in every detail of the varied divisions of his subject. Nothing better can be said of this text than the following extract from the ***British Medical Journal*** in its review, "It is for the opinion of this experienced authority on disputed questions that the reader will most probably search his pages."

INTRODUCTION À LA CHIRURGIE UTÉRINE OBSTETRICALE. By A. Couvelaire, Assistant Professor, Faculty of Medicine, Paris. Paris: G. Steinheil.

This work is divided into two parts: first, the surgical anatomy of the uterus at term, during and after labor; and second, conservative surgery of the uterus at term and in labor. It consists in a series of plates, illustrating various phases of the uterus in pregnancy and in obstetrical operations, each plate

being accompanied by explanatory text. In Part I, these plates, for the most part, are photogravures in sepia, each accompanied by a line drawing to aid in definition. The rest of the plates are half-tone reproductions of wash drawings.

Part II consists of a fairly complete text, with bibliography, describing the major surgical procedures involving the uterus in pregnancy, chiefly the extra- and transperitoneal cæsarean section and vaginal hysterotomy. This is also illustrated by full page plates in half-tone.

The work is based upon preparations in the Baudelocque Clinic specimens dating back to the time of Champetier de Ribes and Varnier, the surgical preparation having been made under the direction of Pinard. The feature of the volume consists in the plates, the author having been fortunate in securing the services of so accomplished an artist. The photogravures are not only scientifically exact but exquisite in creation and most skillfully reproduced.

CAREY CULBERTSON.

NEW ASPECTS OF DIABETES. Pathology and Treatment. Professor Doctor Carl von Noorden. New York City: E. B. Treat & Co.

These lectures delivered at the New York Post-Graduate School upon diabetes give the present conception of the relation of diabetes to the other organs, as well as being an intrinsic discussion of the disease itself. While they do not cover the entire field they are of particular value in relation to the questions of modern research. The author considers that nervous influences stimulate the adrenals to an increased production of epinephrin, while the thyroid and hypophysis on the other hand are supposed to act by depressing the pancreas. These more or less theoretical deductions, while worthy of consideration, really add little to the definite understanding of this disease. The author lays particular stress upon the slight importance of glycosuria in certain phases of the disease. The chapter upon acetonuria will be found very suggestive.

MARRIAGE AND GENETICS, LAWS OF HUMAN BREEDING AND APPLIED EUGENICS. By Charles A. L. Reed, M. D., F. A. C. S. Cincinnati: The Galton Press, 1913.

As set forth in the introduction, the objects of this volume are "to overcome the ignorance which in too many instances keeps innocent victims from protecting themselves and their offspring from disease and degeneracy, to avert many of those conditions that destroy the possible happiness of the marriage state, and convert the bridal chamber into the anteroom of the divorce court." While covering an enormous field, the author has compiled a brief and concise statement of the principles underlying race betterment, and that, too, without subjecting his reader to that moralizing and sermonizing which are so obvious in most popular treatises on this subject. It is written in terms for the lay reader, yet the subject-matter is so well formulated as to be attractive to the scientist desiring some systematic expression of the theme. Thus the doctrines of Lamarch and the discoveries of Mendel, of Weismann and of DeVries, together with Galton's laws are carefully set forth, together with the author's series of ten fundamental laws of race perpetuation, designated as the decalogue of human breeding." In the immense amount of material recently produced on topics relating to marriage and sex hygiene, this volume stands out as a definite expression to perform a definite service.

CAREY CULBERTSON.

TEXTBOOK OF GENERAL AND SPECIAL PATHOLOGY FOR STUDENTS AND PRACTITIONERS. Henry T. Brooks, M. D. Philadelphia: F. A. Davis Co.

In the present-day making of books, we are having a large number that are really compilations of previous treatises, either in our own or some foreign language. It is a question as to how valuable such a book may be, although this is a translation of the work of Langerhans, which has been amplified by taking up the later developments in the field of pathology since the death of Langerhans. It is a concise and necessarily, therefore, to a certain extent unsatisfactory pathology. This book may be recommended generally, although if one searches for a special thing he is likely to find himself somewhat disappointed. The illustrations are mostly copied from other textbooks, particularly from the German, and many of them are in color.

INFECTION AND IMMUNITY. By Charles E. Simon, B. A., M. D. Philadelphia and New York: Lea & Febiger.

The day of the medicine bottle and the tablet box having passed, our attention is attracted toward the more scientific and theoretical methods of treatment, immunology and vaccine versus serum therapy. Shortly the physician's drug store may be carried around in a little pocket case labeled "vaccine and serum." However, a recent observation of Ehrlich would seem to indicate that in his opinion even the vaccinists and serum therapists have reached the limit of their usefulness. He recommends that more advancement be made along chemo-bacterio-tropic lines. The vaccine and serum therapists in turn say that the medicine internists of the old school never did cure anything with drugs except malaria and syphilis, and that all advancement along specific therapy has been by themselves.

Simon writes on the various phases of immunology and serum therapy with striking brilliance, and it can be said without contradiction that his second edition is the most thoroughly up-to-date and reliable book yet written in English on this subject.

There are very interesting chapters on the offensive forces of the invading micro-organisms, and the defensive forces of the macro-organism, chemeotaxis, the side-chain theory, anaphylaxis, active immuniza-

tion, serum therapy, and the methods of demonstration are discussed wherever applicable. A generous space is devoted to the diagnosis and treatment of tuberculosis. The text contains many splendid illustrations.

ABWEHRFERMENTE DES TIERISCHEN ORGANISMUS GEGEN KÖRPER, BLUTPLASMA- UND ZELLFREMDE STOFFE, IHR NACHWEIS UND IHRE DIAGNOSTISCHE BEDEUTUNG ZUR PRÜFUNG DER FUNKTION DER EINZELNEN ORGANE. Von Emil Abderhalden. Berlin: Verlag von Julius Springer, 1913.

This second edition of Abderhalden's investigations concerning the ferments of the plasma and cell substance is, of course, of special interest to all those interested in the scientific side of this question, which undoubtedly in the future will be placed upon a much firmer basis than it is at the present, and it is to be hoped that organotherapy along this line will be removed from the uncertainty which now accompanies it and that we may employ it with the hope of sure results. The author discusses in a comprehensive manner the ferments formed by the white and red corpuscles, blood and tissue cells, and lymph action. He discusses in detail serum of pregnant women, its value in determining pregnancy, and other questions of a like nature.

DISEASES OF WOMEN. Enlarged and Revised Edition. George Ernest Herman, M. B., F. R. C. P., F. R. C. S. Assisted by R. Drummond Maxwell, M. D., F. R. C. S. New York City: Funk & Wagnalls Co., 1913.

This comprehensive text on the diseases of women, for many years one of the most authentic in the British Empire, is now in its fourth edition. The author, long a leading clinician, produced a work which in its early form showed considerable variation from the conventional text. His original aim, as frankly set forth, was to provide a book which "should guide the student and practitioner to the diagnosis and right treatment of the diseases of women." Without regard to anatomical classification, he endeavored to present the different organic affections in the way in which they appeared in practice. Thus the work was classified according to symptoms, a scheme which has some definite advantage from a purely clinical point of view, if confusing to the reader accustomed to the commoner anatomical arrangement. Hence after a few introductory chapters, chronic pelvic pain is discussed, then pelvic inflammation, and next internal hæmorrhage. Part V takes up hæmorrhage in general and is followed by five short chapters on leucorrhœa. The disorders of menstruation and of the sexual functions come next, followed by urinary and rectal complications. The volume concludes with a complete presentation of abdominal tumors.

This arrangement is continued in the new edition, diagnosis and treatment again being emphasized. The greatest change in the present volume is seen in the parts relating to operative technique, the portion of the work revised by Dr. Maxwell. Thus in the plastic work of the cervix and vagina, and in radical extirpation for malignancy, as well as in many other instances, the revision has added greatly to the value of the book as a text.

Many of the illustrations are new, including eight in color. Another excellent feature is the index, divided into two parts, a general index and one of authorities, each much amplified.

CAREY CULBERTSON.

A MANUAL OF X-RAY TECHNICUE. A. C. Christie, Captain, Medical Corps, United States Army. Philadelphia & London: J. B. Lippincott Company.

This manual by Christie is a condensed text on the application of X-rays in diagnosis and treatment. The book may be found very useful to the physician and surgeon in private practice, especially so to those who are in the rural districts and who find it necessary to do their own radiography. One commendable feature of the book is its brevity and conciseness. X-ray operators are urged to make themselves familiar with the use and construction of the different forms of X-ray machinery and are shown the simplest methods for obtaining the best results. A careful study of this little manual will greatly aid the operator in becoming proficient in this branch of diagnosis and treatment.

LEHRBUCH DER PRAKTISCHEN CHIRURGIE FÜR ÄRZTE UND STUDIERENDE. L. Gelpke, M. D., and C. Schlatter, M. D. Leipzig: Johann A. Barth, 1913.

This work, appearing in two volumes, is designed for both student and practitioner. The text is relatively short, yet complete and comprehensive and arranged in a logical manner, facilitating ready reference. Various theoretical problems are omitted, giving way to practical descriptions of surgical conditions and their causative factors, together with explicit suggestions as to treatment. The first chapters are devoted to the principles of general surgery, including injuries, acute and chronic infections, and tumors, and the following chapters are devoted to regional surgery. Many of the latest advances in surgical treatment are given, which bring the work up to date.

H. A. POTTS.